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NANTICOKE ENVIRONMENTAL MANAGEMENT PROGRAM

ANALYSIS OF O_3 EXCEEDANCE EPISODES IN THE HALDIMAND-NORFOLK REGION FOR 1979-1983

REPORT NO. ARB-005-85-ARSP

January, 1985

NANTICOKE
ENVIRONMENTAL
MANAGEMENT
PROGRAM

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Participants: Environment Canada • Ontario Ministry of the Environment • Ontario Hydro • Stelco Inc. • Texaco Canada Inc.

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1.0 Introduction

At high concentrations, ozone can cause damage to vegetation, destruction of materials and human discomfort, (Mukammal (1965), Heck et al (1982)). Of all the contaminants which are monitored in the Haldimand-Norfolk region, the hourly air quality criterion (AQC) for ozone (80 ppb) is most frequently exceeded. It is worth noting here that ozone is not directly emitted from industrial processes but is produced by chemical reactions in the atmosphere. Emissions of hydrocarbons and nitrogen oxides act as precursors which, in the presence of sunlight, eventually lead to the formation of ozone. Local industrial operations are not an important contributor to elevated ozone levels in the Haldimand-Norfolk region of southern Ontario.

Three stations in the NEMP network (Figure 1) monitor ozone levels -Long Point (SW37), Simcoe (WNW19) and Binbrook (NNE39). Over the five year period 1979 to 1983, there have been a total of 1497 exceedances of the AQC for ozone recorded at the above three stations. Most of these have occurred during the summer months (June to August), with isolated occurrences in April, May and September. Warm temperatures and strong insolation combined with southerly flows during this time of the year coincide with the elevated ozone levels. The specific meteorological conditions coincident with elevated ozone concentrations have been described by Vukovich et al. (1977), Yap and Chung (1977) and Mukammal and Neumann (1981) - namely, southerly flows associated with the back (westerly) portion of anticyclones, the stagnation of anticyclones, the development of land/lake breeze circulation cells and the passage of warm fronts.

In this report, ozone exceedance events which occurred in the Haldimand-Norfolk region (1979 to 1983) are classified according to the meteorological conditions existing at the time of their occurrence. After an analysis of the number of local AQC exceedances by season, time of day and wind direction (Section 2), a selected number of events will be considered in more detail (Section 3), for purposes of illustration, including an analysis of the concurrent synoptic weather conditions, local meteorology, back air trajectories and mixed layer heights (when available). Details of meteorological conditions on days when O_3 concentrations exceeded the hourly provincial AQC (80 ppb) on three consecutive hours are given in the Appendix.

2.0 Seasonal, Daily and Directional Influences on Ozone Levels in the Haldimand-Norfolk Region

The distribution of O_3 exceedances of the AQC in the Haldimand-Norfolk region (1979-1983) by station is shown in Figure 2. Hourly averaged O_3 exceedances were most frequent at Long Point (770 exceedances) and decreased inland (Simcoe - 583 exceedances and Binbrook - 144 exceedances) Figure 3 presents the hourly averaged O_3 concentrations by station for the summer period of 1980. Average O_3 levels are highest at the coastal site and decrease as distance from the shoreline increases.

The diurnal trend in ozone exceedances for the entire period 1979 to 1983 is illustrated in Figure 4. Ozone exceedances are most frequent during the late afternoon (1500 to 1900 EST) and least frequent during the early morning period (0400 to 0900 EST). In addition, the diurnal patterns for temperature and O_3 concentration are similar.

Relatively low ozone levels (30-50 ppb range) usually occur on days of cooler air temperatures and northerly winds. During exceedance events (1979 to 1983) the maximum surface air temperature averaged 27^{o}C whereas the maximum air temperature for the entire summer averaged only 24^{o}C.

Seasonally, ozone exceedances occur most often during the summer period (June, July and August). Seventy-eight percent of the total number of hourly ozone exceedances (1979 to 1983) occurred during the summer compared with 15% and 7% during the spring (March, April and May) and fall (September, October and November) seasons respectively. There were no exceedances during winter. The growing season (May to September) recorded 98% of the ozone exceedances throughout 1979 to 1983.

In the Haldimand-Norfolk region, O_3 exceedances occur most frequently with winds from the S to SW sector, as illustrated in Figures 5 and 6. Eighty-six percent of the hourly ozone exceedances during peak ozone daylight hours (1300 to 1900 EST inclusive) for the five summers (June, July and August 1979-1983) coincided with winds from the ESE to WSW sector. Ozone exceedances coincided with wind flow from the northwest to northeast sector a mere 6% of the time. The above daylight hours were chosen because ozone concentrations were generally higher and available wind measurements were more representative of the actual large scale circulation during these hours.

Examination of the percentage frequency of occurrence of hourly averaged wind speed with ozone levels exceeding 80 ppb is presented in Figure 7, for the hours 1300 to 1900 EST during the summer seasons (1979 to 1983). Ozone exceedances occurred most frequently with moderate (16-30 km/hr) wind speeds.

3.0 Ozone Episode Analysis

The identification and analysis of occasions during which episodes of elevated ozone levels occur in the Haldimand-Norfolk region is the main aspect of this report. For the purpose of analysis, an episode was defined as the occurrence of ozone levels greater than 80 ppb for three or more hours at any one station on the same day.

Throughout the 5 year period (1979 to 1983), there were 133 ozone episodes. The majority of these episodes occurred in June (39) and July (43). The distribution of ozone episodes by month is presented in table 1. Out of the total number of ozone episodes, 129 occurred during the growing season.

The daily peak ozone level for ozone episodes occurred at 1700 EST. The frequency with which peak O_3 levels occurred at each hour of the day is shown in Figure 8.

The number of hours that the hourly ozone levels exceeded 80 ppb (on any episode day) is indicative of the severity of the ozone episode. Table 2 shows the frequencies of occurrences of these duration periods in the Haldimand-Norfolk region.

3.1 Statistics on Ozone Episodes and Associated Meteorological Conditions

In the Appendix, each event is described according to the meteorological conditions which existed at the time of it's occurrence. Of the 133 episodes which were recorded in the Haldimand-Norfolk region throughout 1979 to 1983; 91 coincided with an anticyclonic weather system and accompanying clear skies, warm temperatures and southerly winds; 19 were observed with frontal activity (on 9 of these occasions precipitation was recorded) and 23 coincided with a lake breeze influence.

In the following section of the report, typical examples of ozone episodes during the above meteorological categories will be discussed.

3.2 Ozone Episodes and High Pressure Systems

It has been previously noted that elevated ozone occurs with high pressure systems, and in particular, the largest O_3 concentrations are found on the back-side of a moving high pressure system, (Vukovich et al. 1977). Figure 9, taken from Yap and Chung (1977), describes the synoptic weather situation often accompanying elevated ozone levels in the Haldimand-Norfolk region. Ozone episodes are typically associated with a high pressure system centred to the east of the lower Great Lakes, creating a south to south-southwesterly flow on the backside of the anticyclone. Accompanying the moist southerly flows are warm temperatures.

The episode of September 10-13, 1982 is a good example of the occurrence of elevated ozone concentrations when southerly flows occur with a quasi - stationary high pressure system situated near the study area. On the morning of September 10, 1982 a high pressure system centred to the east of the Nanticoke area, created a southerly flow across the region (Figure 10). Surface winds (as measured by the 10 m level of the Jarvis met. tower) were calm throughout the night becoming southerly (10-15 km/hr) during the afternoon (Figure 11a). Surface air temperatures reached a maximum 28^{o}C. Skies were free of clouds; however visibility was restricted by haze. Mixed layer heights (as measured by the acoustic sounder located 7 km north of the shoreline) remained below 200 m for the entire afternoon period (Figure 11b). Ozone levels exceeded the 80 ppb hourly AQC for nine consecutive hours (1300 to 2100 EST) at Long Point. Elevated ozone was also recorded at Simcoe (maximum 81 ppb) and Binbrook (maximum 79 ppb) - see Figure 11c. Back trajectories of the air parcels which arrived in Southern Ontario on September 10, showed origins to the west-southwest (Figure 11d). These air parcels traversed the highly industrialized Detroit, Michigan area before arriving at Nanticoke, and in doing so accumulated ozone and ozone precursors. Note that these trajectories are based on the gradient wind as computed from the height field at the 850 mb pressure level and they are used to follow the air mass back 48 hours (in 6 hour increments) to find its origin.

Similar meteorological conditions continued on into September 11 and 12 (Figure 12 and 13 respectively). Consequently, the surface winds remained light and southerly for the entire two day period. Once again, surface air temperatures increased rapidly after sunrise, reaching 27°C on September 11 and 28°C on September 12. Visibility was restriced by haze on both days. At Long Point, ozone exceedances were recorded for 10 continuous hours (1400 to 2400 EST) on September 11 and for 5 hours (1600 to 1800; 2200 to 2300 EST) on September 12. One hourly exceedance (82 ppb at 2300 EST) was recorded at Simcoe on the 11th and two (1500 and 1600 EST) on September 12. Binbrook ozone levels reached 71 ppb on September 11 and 80 ppb on September 12.

On September 13, the high pressure system moved northeastward and by 1300 EST, it was centred over the Atlantic seaboard to the east of Quebec City (Figure 14). Surface winds were light (11 km/hr) and from the south throughout the afternoon becoming calm by early evening (Figure 15a). The air mass over Nanticoke on September 13 showed a previous 48 hour movement from the Ohio Valley, north-northeastward to Nanticoke (Figure 15b). Ozone levels peaked at 97 ppb at Long Point and exceeded the hourly AQC for 7 consecutive hours. The maximum hourly concentration at Simcoe and Binbrook was 73 and 53 ppb respectively (Figure 15c).

On September 14 a cold front passing through the Nanticoke area produced cloudy skies, northerly winds and a gradual drop in air temperature. The ozone levels did not exceed the AQC on this day.

Meteorological conditions were similar throughout the four day ozone episode (September 10 to 13, 1982), namely; light southerly winds on the back-side of the anticyclone; maximum surface air temperatures in the 27-29°C range; clear skies and previous air mass movement over the highly industrialized areas of the U.S.A.

3.3 Ozone Episodes Associated with Lake Breeze Influence

Lake breeze days are characterized by light winds, weak pressure gradients, warm temperatures and sunny skies. Mukammal et al. (1981) have attributed some incidences of elevated ozone near Lake Erie to the onset of lake breezes. The effects of lake breeze circulation on pollutant dispersal have been

discussed in detail by Lyons and Olsson (1973) and Keen and Lyons (1978). Pollutants are trapped and recirculated within the lake breeze cell with stratified layers forming over the lake and a fumigation zone occurring when layers aloft intersect the developing thermal internal boundary layer. At night weak land breezes tend to move pollutants offshore, where they accumulate and become part of the lake breeze circulation during the following day. In our study, ozone episodes associated with lake breeze occurrence have arisen from precursors emitted into the circulation locally as well as across the border at major industrial complexes such as Cleveland and Detroit. Examination of the winds prior to the onset of the lake breeze indicates the problable source of the pollutant. Westerly winds implicate Detroit emissions; southerly winds, those from Cleveland; and calm conditions or northerly flows, those from local sources.

July 8, 1979 is an example of an occasion on which elevated ozone levels in the Haldimand-Norfolk region coincided with a lake breeze influence. On this day a high pressure cell was centred off the Atlantic coast (Figure 16). The pressure gradient in the Nanticoke area was weak, the sky was free of clouds and the maximum surface land temperature was 27^{o}C. These conditions all contributed to the development of a lake breeze regime. Surface winds in the Nanticoke area were calm throughout the early morning hours becoming southerly by 1100 EST (Figure 17a). The lake breeze persisted for eight hours. The breakdown of the lake breeze around 1800 EST coincided with the beginning of a decrease in ozone levels (Figure 17b). Ozone concentrations were lowest at Binbrook, the furthest monitor location inland. Such a decrease in ozone concentration inland from the lake reflects the degree of penetration of the lake induced circulation.

3.4 Ozone Episodes Observed With Frontal Activity

The previous mentioned features by no means encompass all conditions under which elevated ozone levels were observed. Mukammal et al. (1981) have attributed an increase in ozone levels to the presence of synoptic fronts and in particular Mukammal (1965) suggested that on occasion, thunderstorm activity associated with these frontal systems may have contributed to higher ozone concentrations.

There were 19 ozone episodes in the Haldimand-Norfolk region which were observed during frontal activity. Meteorological conditions associated with these episodes can be described by one of the following synoptic situations. The first synoptic situation showed a weak frontal disturbance over the Great Lakes, orientated along a NE/SW axis with a high pressure cell situated to the northwest and southeast. Thunderstorm activity was observed in the Nanticoke area during these occasions. The second synoptic situtation showed a cold front approaching from the northwest while the third situation showed that a warm front had passed through the region prior to the exceedance episode. The diurnal pattern of ozone during the above synoptic situations usually showed a very sharp peak and on occasion there was a secondary peak in the early morning hours. The AQC under these conditions exceeded only for a short duration. Thunderstom activity and/or strong vertical mixing associated with the front are the likely mechanisms responsible for the high levels of 0_3 at the ground. However, warm, southerly flows associated with the backside of the high pressure system may have initially transported the ozone and ozone precursors into the region. For the majority of episodes observed with frontal activity it is difficult to determine the time of frontal passage from the 6 hour synoptic maps, making it difficult to assess its impact on the ozone levels.

The episode of July 19, 1981 is an example of elevated ozone observed with frontal activity. The normal diurnal ozone pattern is changed due to thunderstorm activity associated with a frontal disturbance. On July 18, 1981, mid afternoon ozone levels reached over 100 ppb in the area. After sunset, ozone levels dropped to 50 ppb but remained higher in a layer at the top of the inversion. Downdrafts associated with the thunderstorm activity during the early morning hours of July 19 (Figure 18), may have caused the sharp increase in ozone concentrations (as high as 82 ppb) at 0500 EST. Following the thunderstorm, ozone levels returned to near 50 ppb during the morning, and increased again to about 100 ppb during the late afternoon, Figure 19a. Back trajectory analyses indicate that the air mass which brought high ozone levels to the area during the episodes of July 18 and 19 passed over the highly industrialized area of southern Michigan, Figure 19b.

3.5 Ozone and Northerly Flows

In conclusion, it should be pointed out that northerly flows typically are associated with low ozone concentrations in the Nanticoke area. Such flows usually occur on the east side of an approaching anticyclone. June 3, 1982 is one of many examples of this type of situation. On this day, a high pressure system centred over the upper Great Lakes produced a light northeasterly flow over the Nanticoke region (Figure 20). Ozone levels were low (<40 ppb) at all three monitoring locations for the entire 24 hour period (Figure 21a). Accompanying the northerly winds were cool surface air temperatures (maximum 14°C) and clouds, conditions which do not favour the formation of ozone. Finally, the 48 hour back air trajectory showed an air mass origin to the northwest of Nanticoke (Figure 21b).

4.0 Summary

In the Haldimand-Norfolk region (1979 to 1983), there were 1497 hourly exceedances of the AQC (80 ppb) for ozone. Examination of the frequency of occurrence of these exceedances revealed that:

1) June (540) and July (469) were the months that recorded the greatest number of hourly ozone exceedances
2) 85% of all ozone exceedances occurred during the growing season (May - September).
3) The daily peak ozone level occurred most frequently at 1700 EST
4) Daily mean ozone levels were highest at the shoreline site (Long Point) and decreased as distance inland increased
5) Ozone exceedances occurred most frequently during moderate (16-30 km/hr) south to south-southwesterly winds

As suggested by other workers (Yap and Chung (1977); Vukovich (1977) and Mukammal et al. (1981)), it was confirmed that ozone episodes in the Haldimand-Norfolk region were observed with the following meteorological conditions: anticyclonic weather systems with accompanying clear skies, warm temperatures and southerly flows; pre cold/post warm frontal passages (with or without precipitation); and finally the lake breeze influence. Examination of 133 ozone episodes revealed that 68% coincided with back or centre of the high situations, 17% coincided with lake breeze influence and 14% with frontal activity.

Trajectory analysis suggests that air masses with previous origins to the south and west accumulate ozone and ozone precursors which contribute significantly to the levels of ozone in the Haldimand-Norfolk region. Local industrial operations are not important contributors.

AR36-10

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Table 1

Ozone Episodes by Month and Year - 1979 to 1983

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1979	0	0	0	1	2	8	7	2	3	0	0	0	23
1980	0	0	0	0	3	6	11	4	0	0	0	0	24
1981	0	0	0	0	4	7	9	4	3	0	0	0	27
1982	0	0	0	1	4	5	8	4	4	0	0	0	26
1983	0	0	0	1	0	13	8	8	2	1	0	0	33
Total	0	0	0	3	13	39	43	22	12	1	0	0	133

Table 2

Frequency of the Number of Hours that Ozone
Exceeded 80 ppb on Episode Days

Duration *	Frequency
3	29
4	24
5	15
6	7
7	8
8	6
9	10
10	10
11	6
12	8
13	2
14	2
15	6

* number of hours on each episode day that O3 > 80 ppb

Figure 1

Ozone Monitoring Network in the Haldimand-Norfolk Region

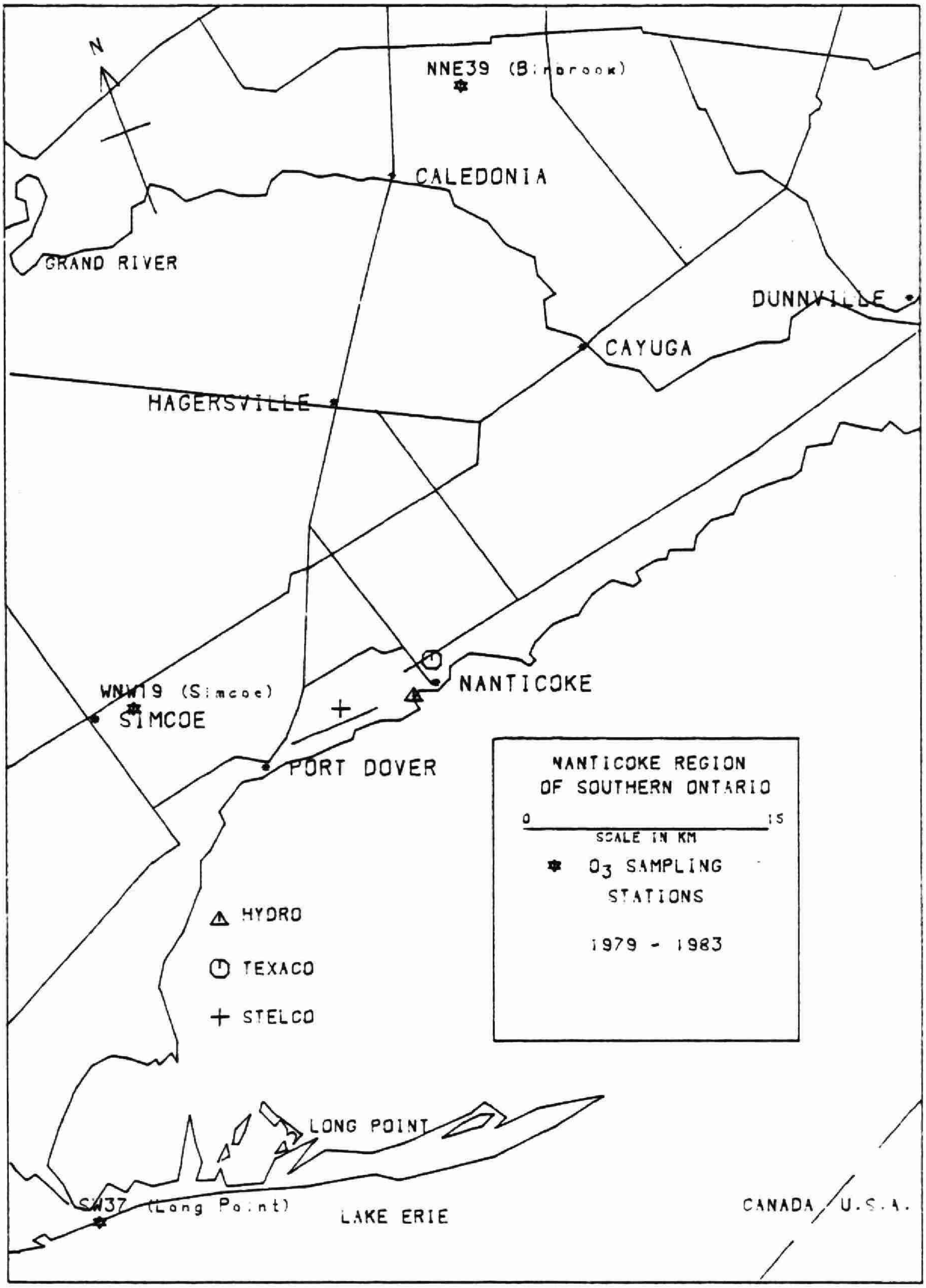


Figure 2

Distribution of Hourly Ozone Exceedances
by Year and Station

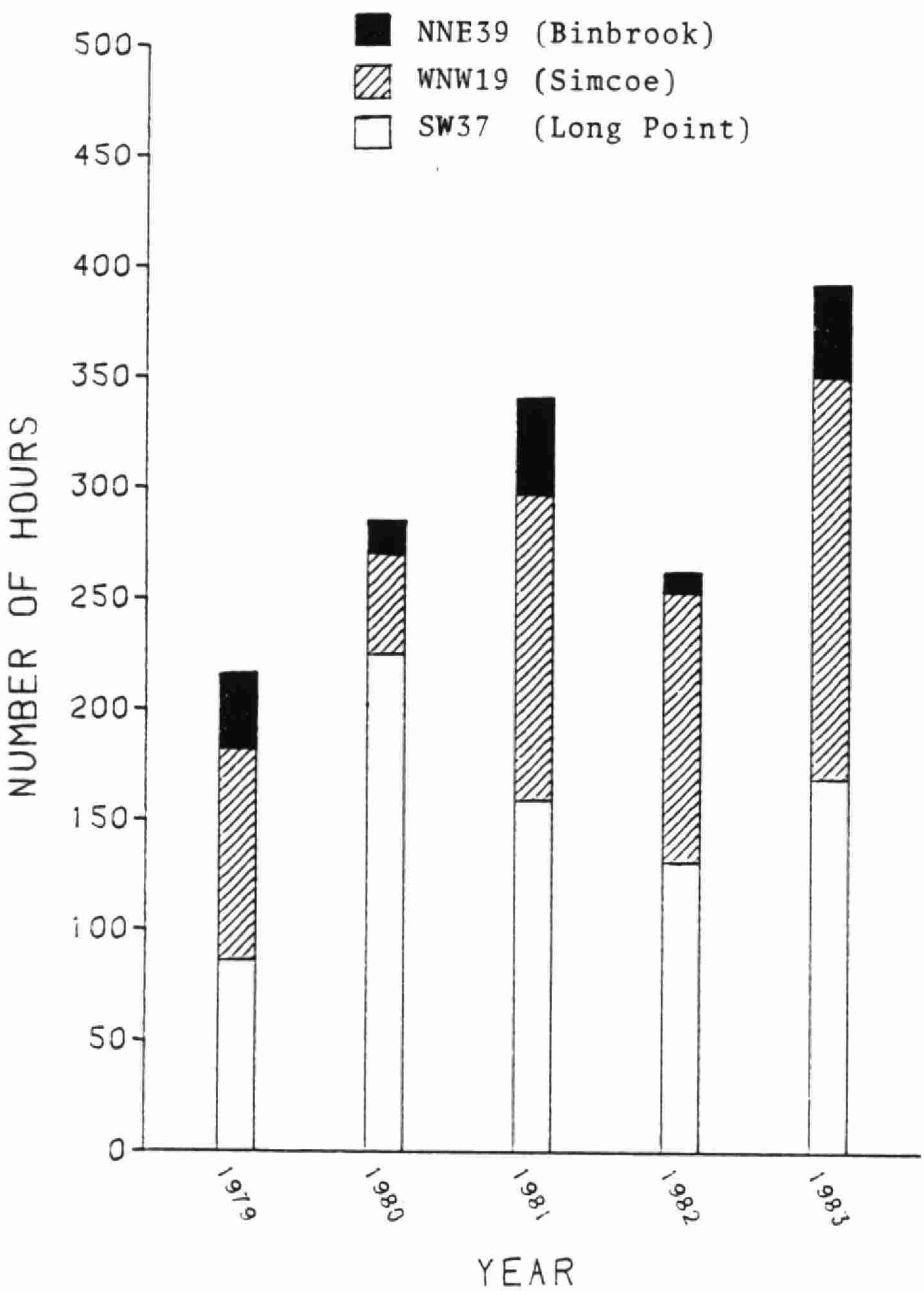


Figure 3
Hourly Averaged Ozone Concentrations for the Summer Months of 1980

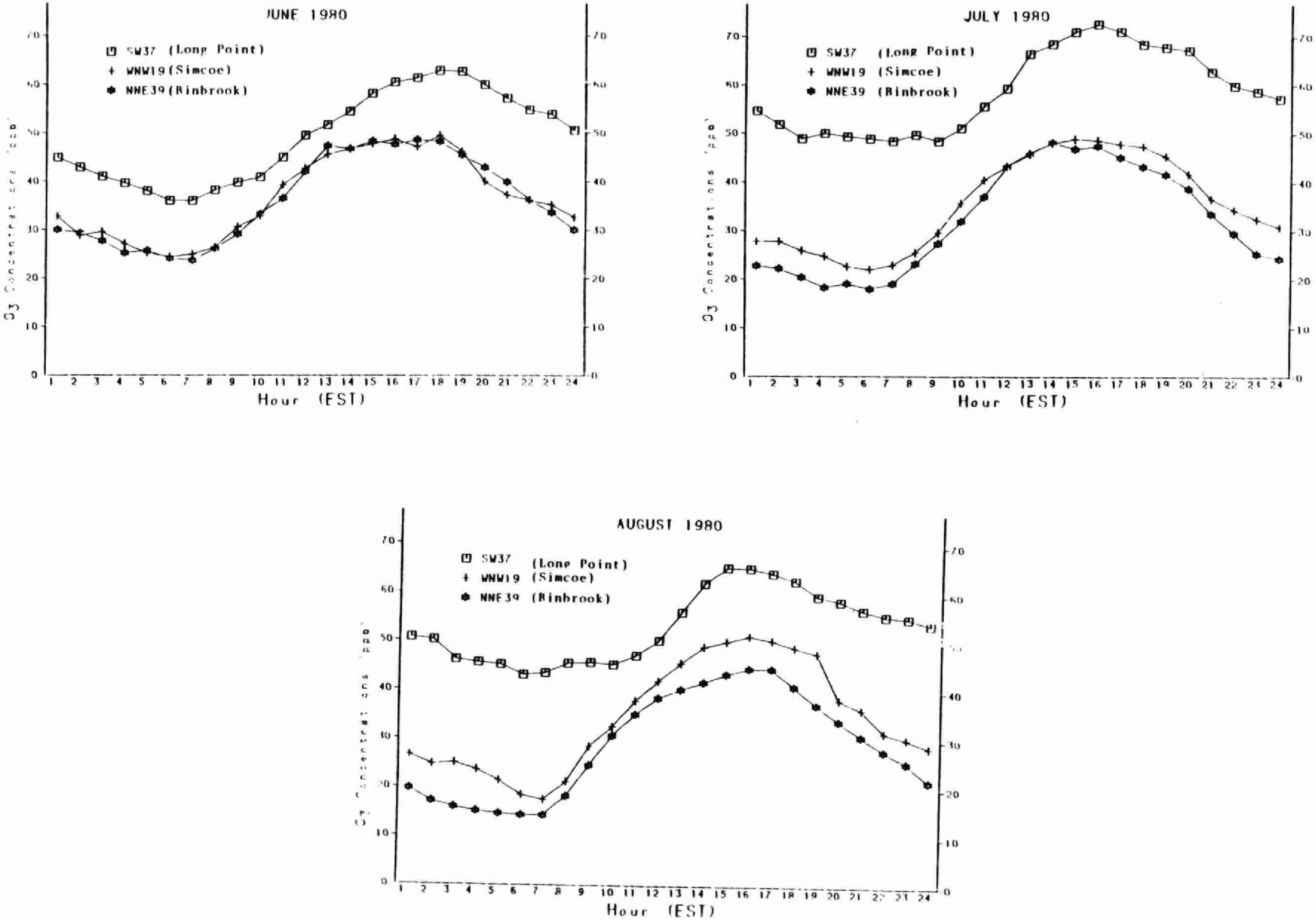


Figure 4

Diurnal Trend in Ozone Exceedances
and Air Temperature

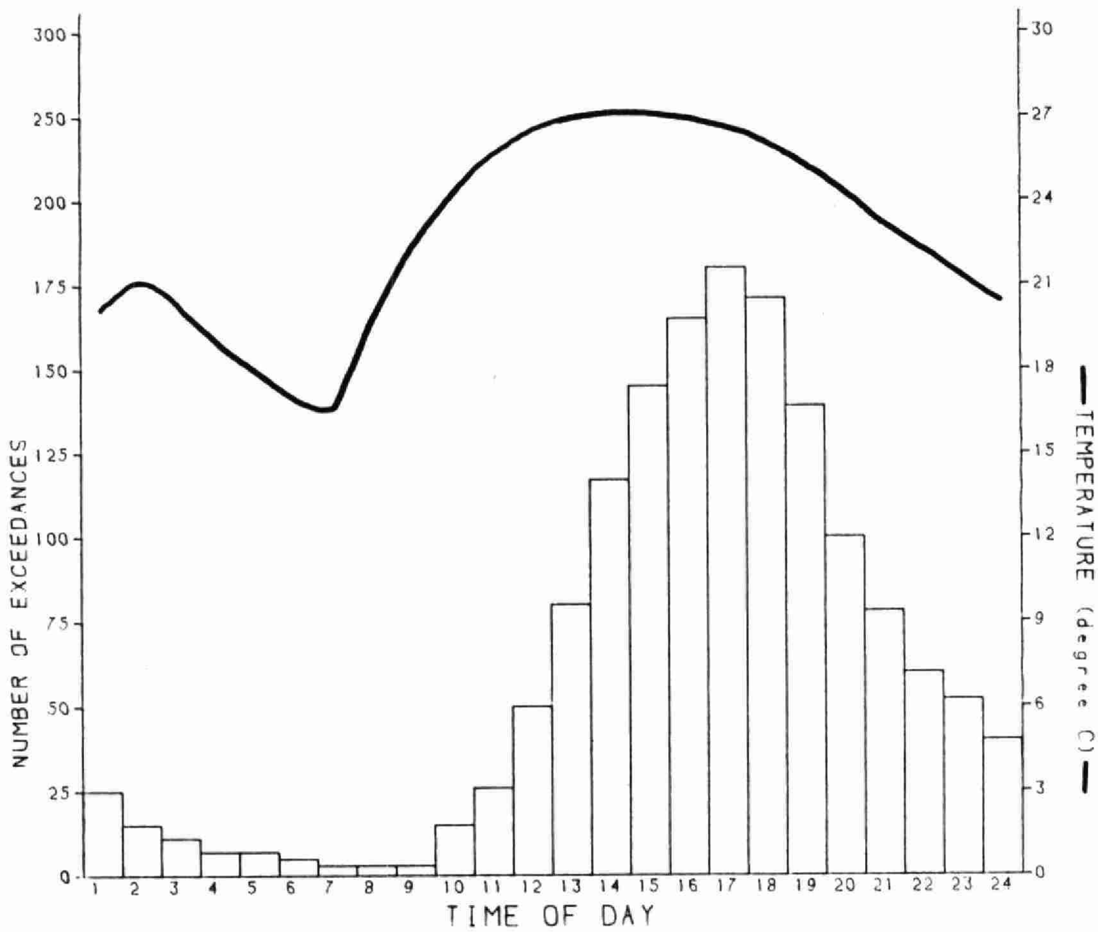


Figure 5

Concentration Rose for Hourly Ozone Exceedances

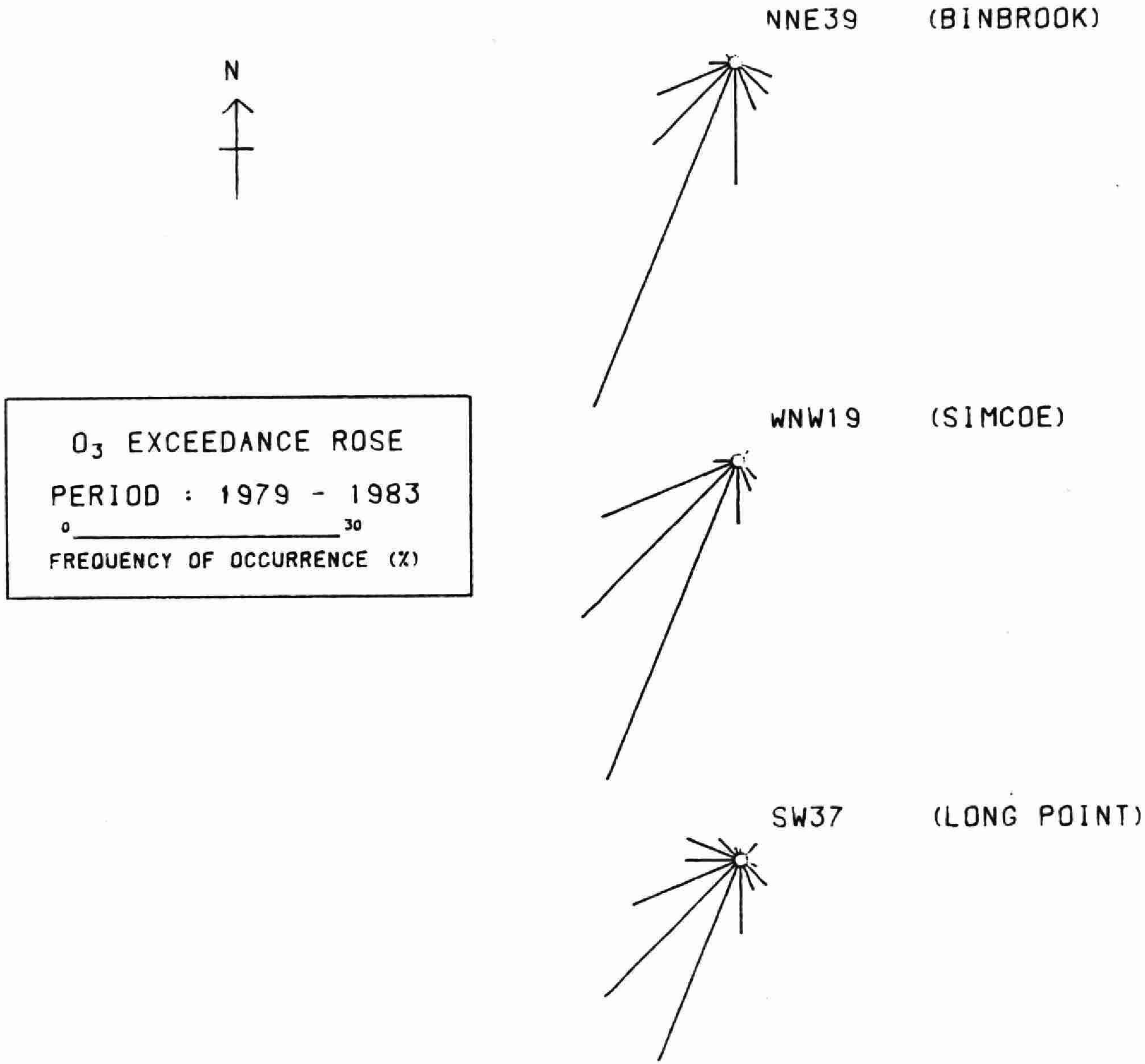


Figure 6

Frequency Distribution of Hourly Wind Direction for Hourly Ozone Exceedances During Peak Ozone Daylight Hours (1300 to 1900 EST)

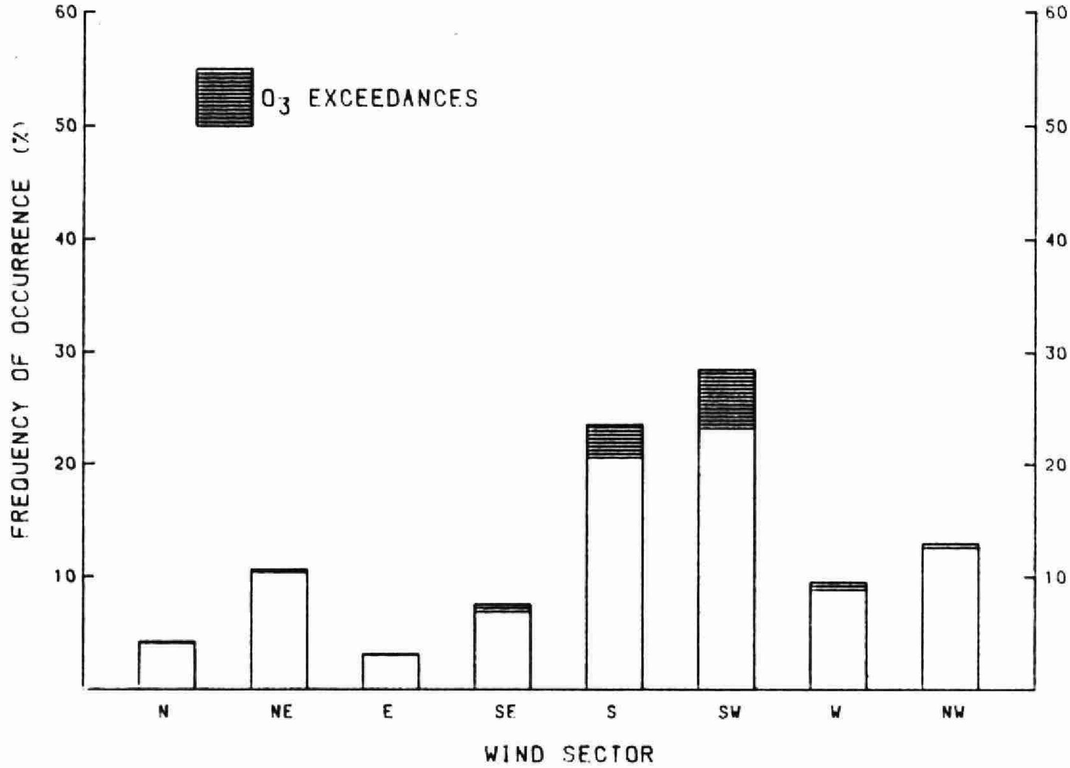


Figure 7

Frequency Distribution of Wind Speed for Hourly Ozone Exceedances During Peak Ozone Daylight Hours (1300 to 1900 EST)

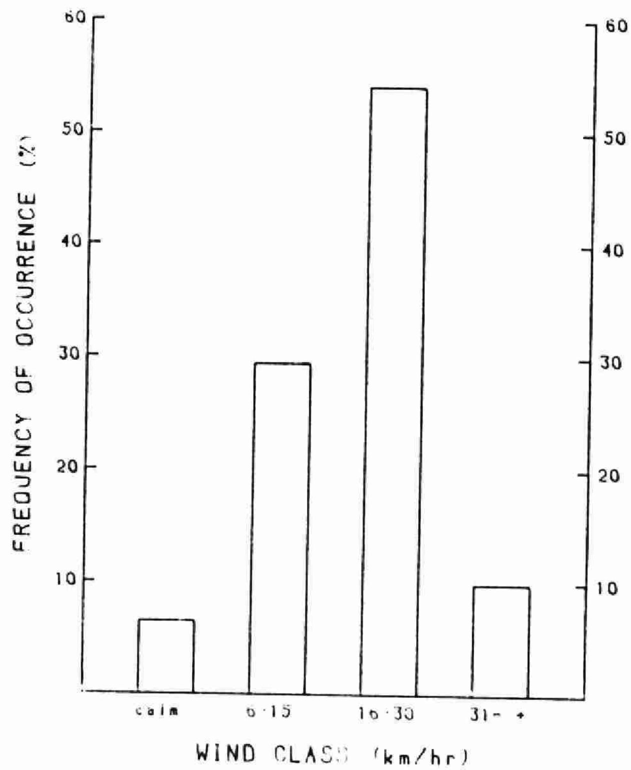


Figure 8

Frequency With Which Peak O3 Levels Occur at Various Hours of the Day on Episode Days in Haldimand-Norfolk Region

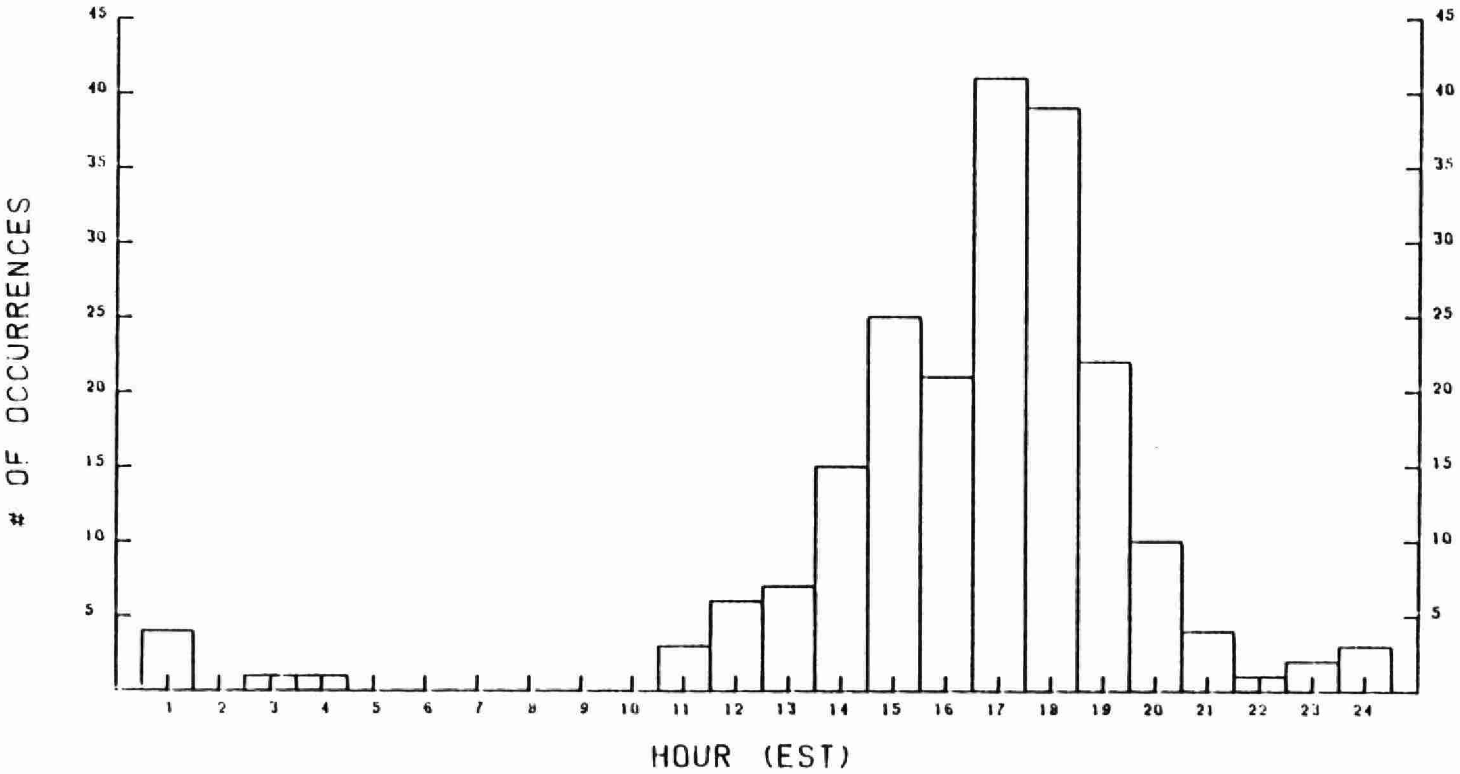


Figure 9

A SCHEMATIC DIAGRAM OF THE RELATIONSHIP OF OZONE LEVEL AND SYNOPTIC WEATHER SITUATION

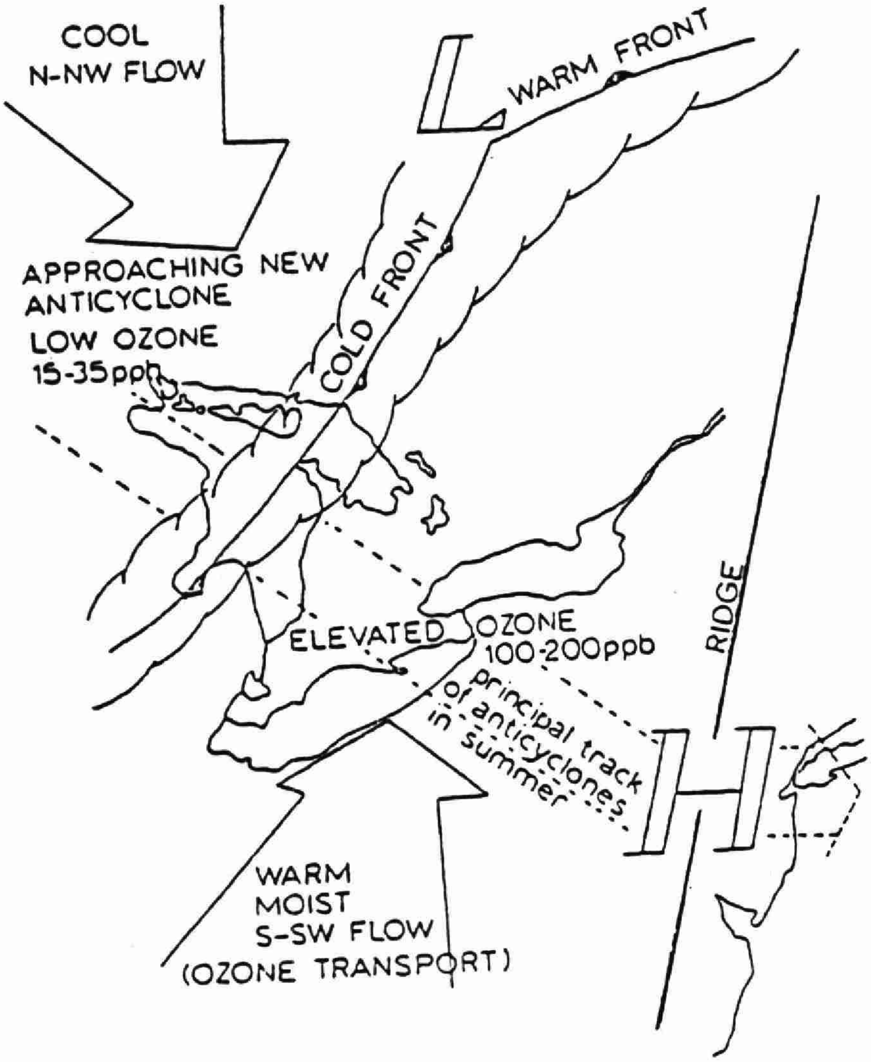


FIGURE 10

SURFACE SYNOPTIC MAP FOR SEPTEMBER 10,1982
1300 EST

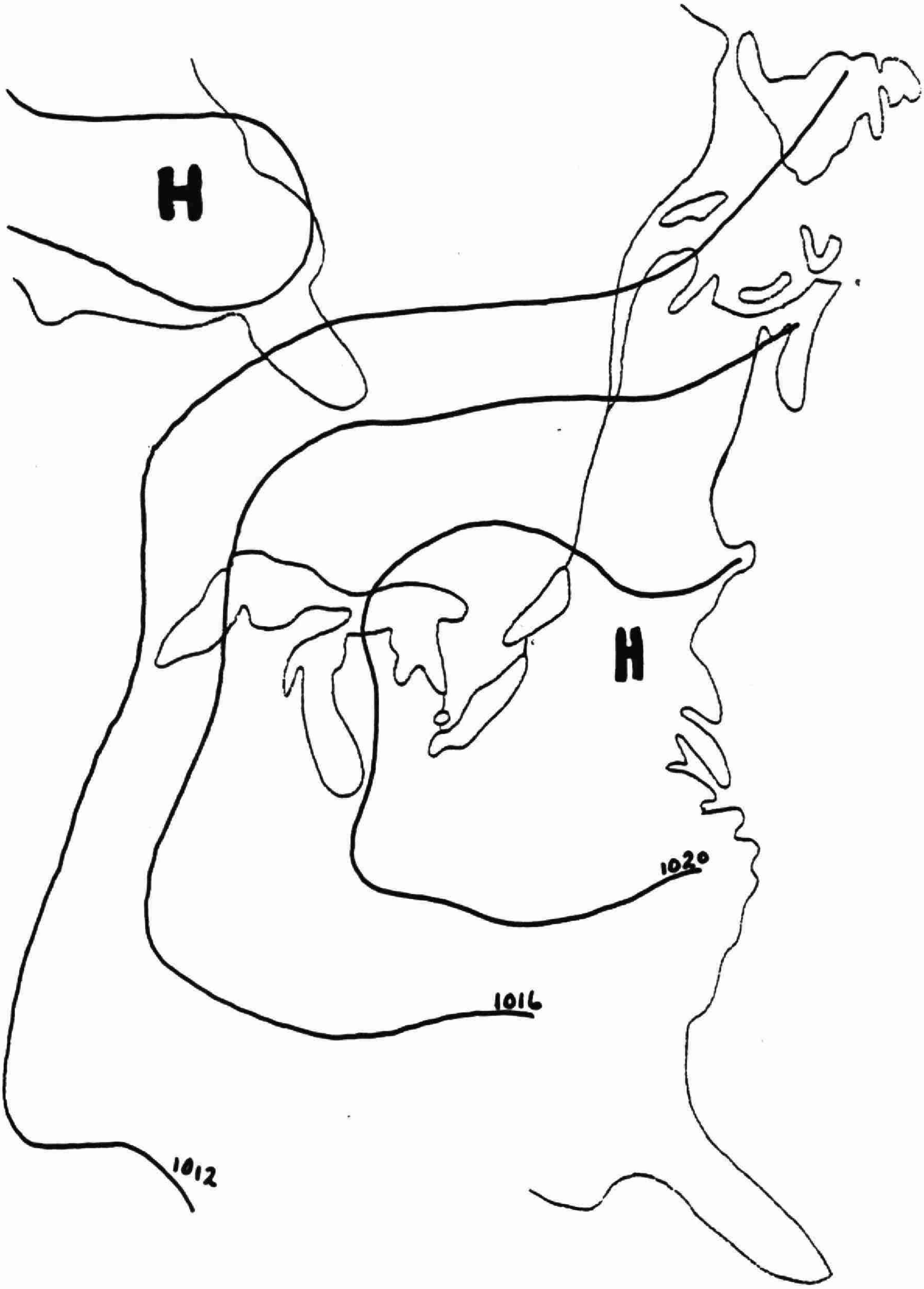


Figure 11a Diurnal Pattern of Winds for September 10,1982
at the Jarvis Met Tower

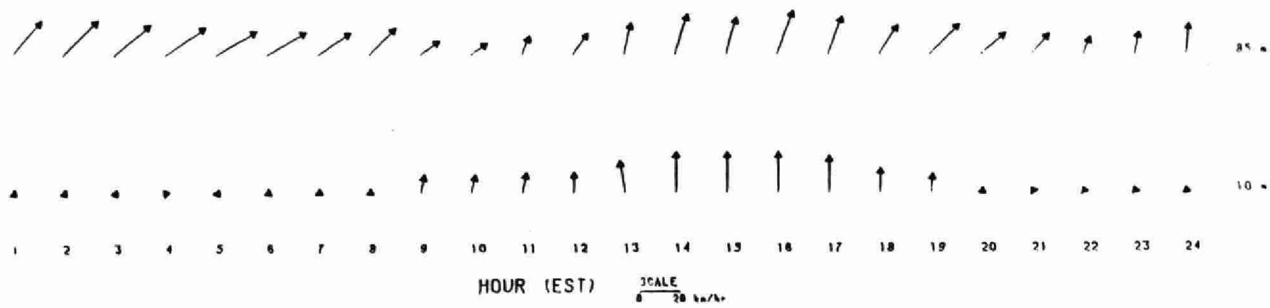


Figure 11b Mixed Layer Heights for September 10,1982

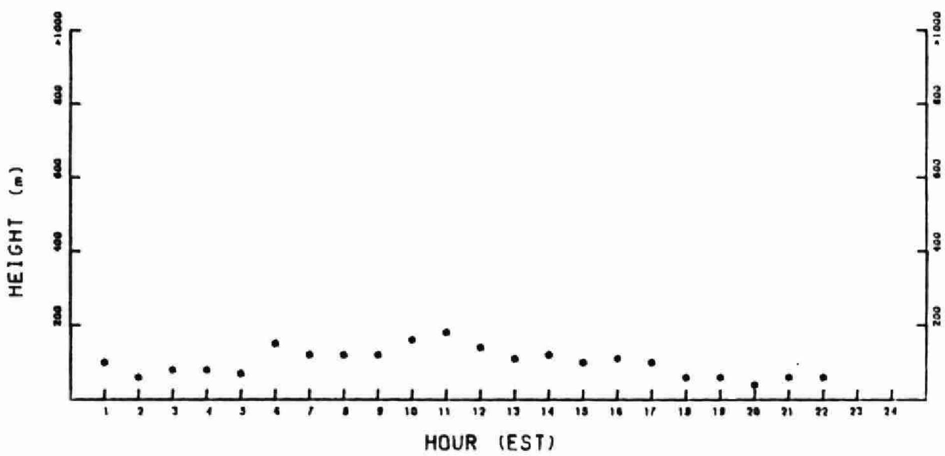


Figure 11c Diurnal Pattern of Ozone Concentration for September 10,1982

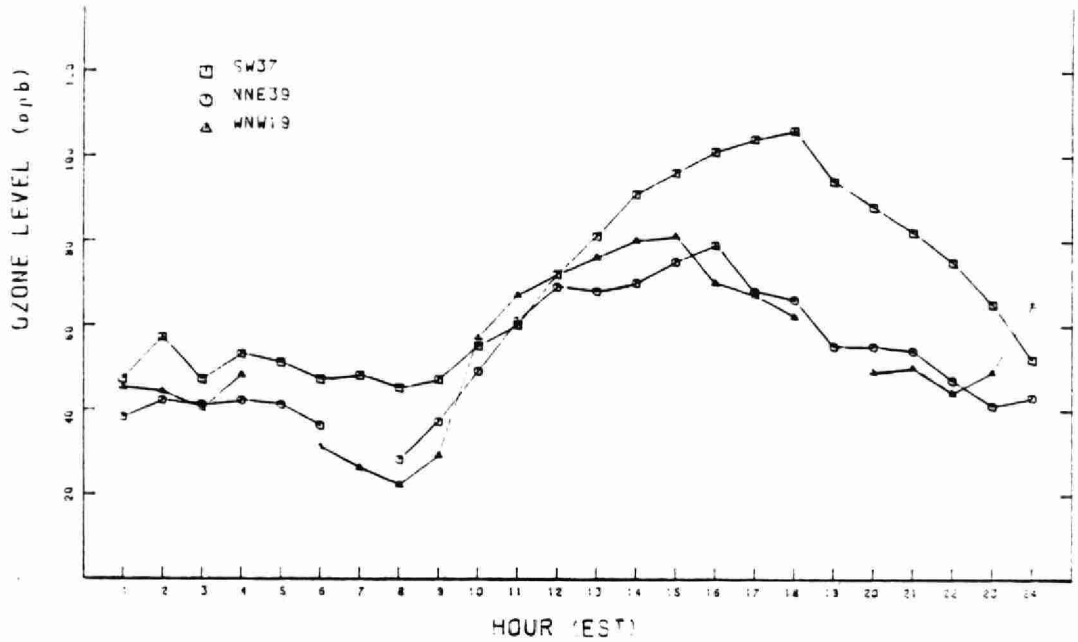


Figure 11d 48 Hour Back Trajectory Plot for September 10,1982

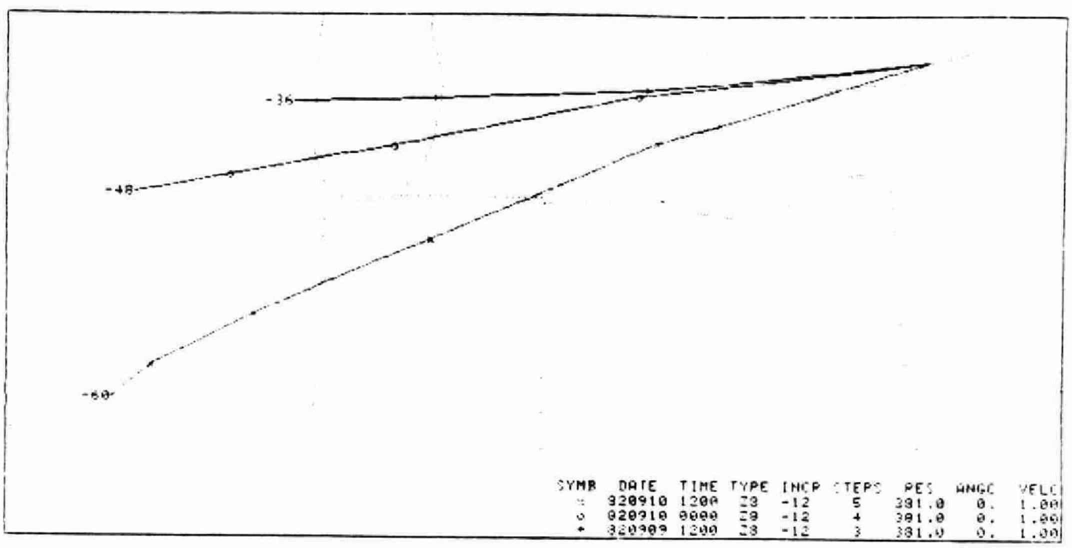


FIGURE 12

SURFACE SYNOPTIC MAP FOR SEPTEMBER 11,1982
1300 EST

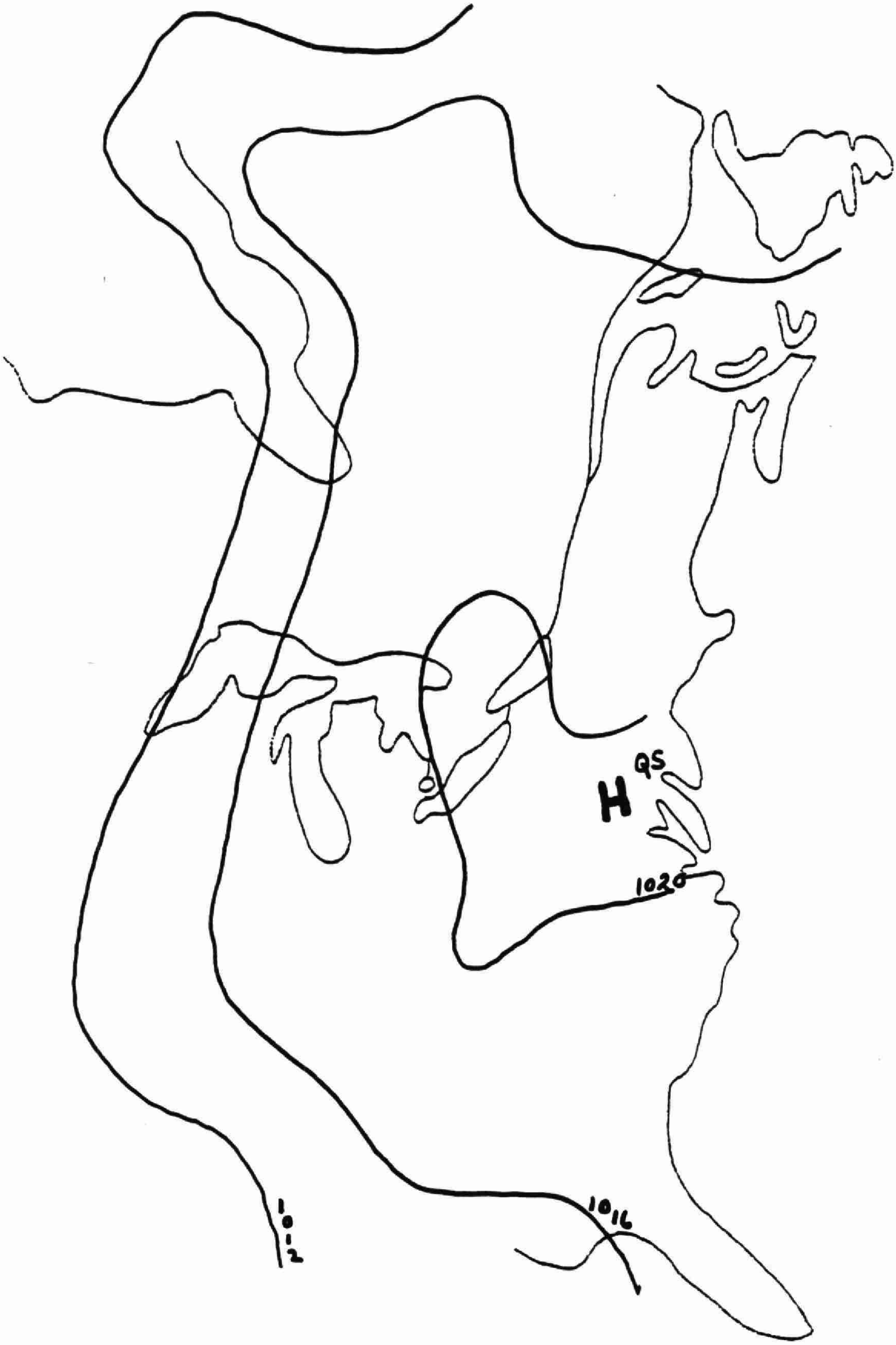


FIGURE 13

SURFACE SYNOPTIC MAP FOR SEPTEMBER I2,1982
1300 EST

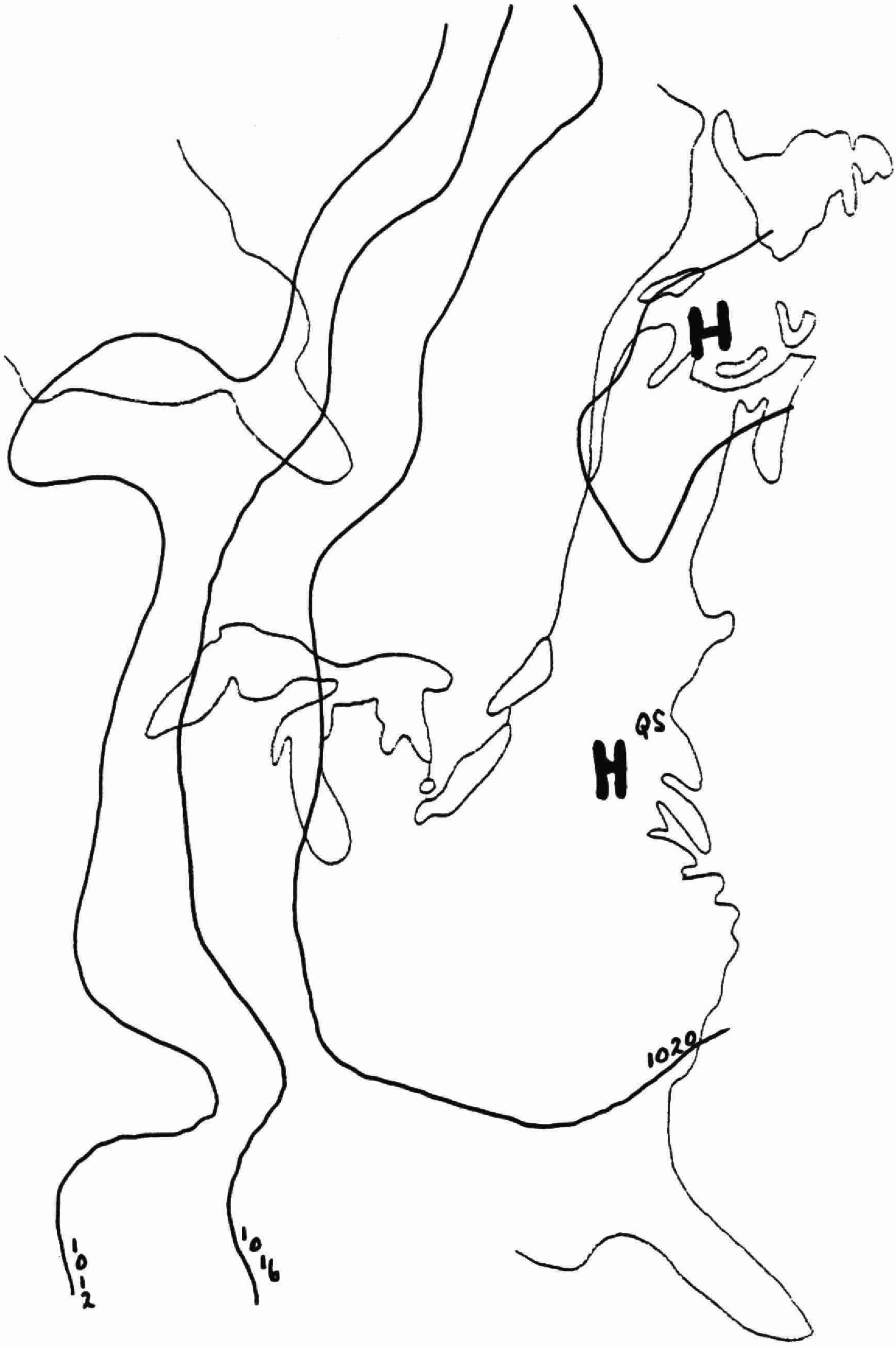


FIGURE 14

SURFACE SYNOPTIC MAP FOR SEPTEMBER 13,1982
1300 EST

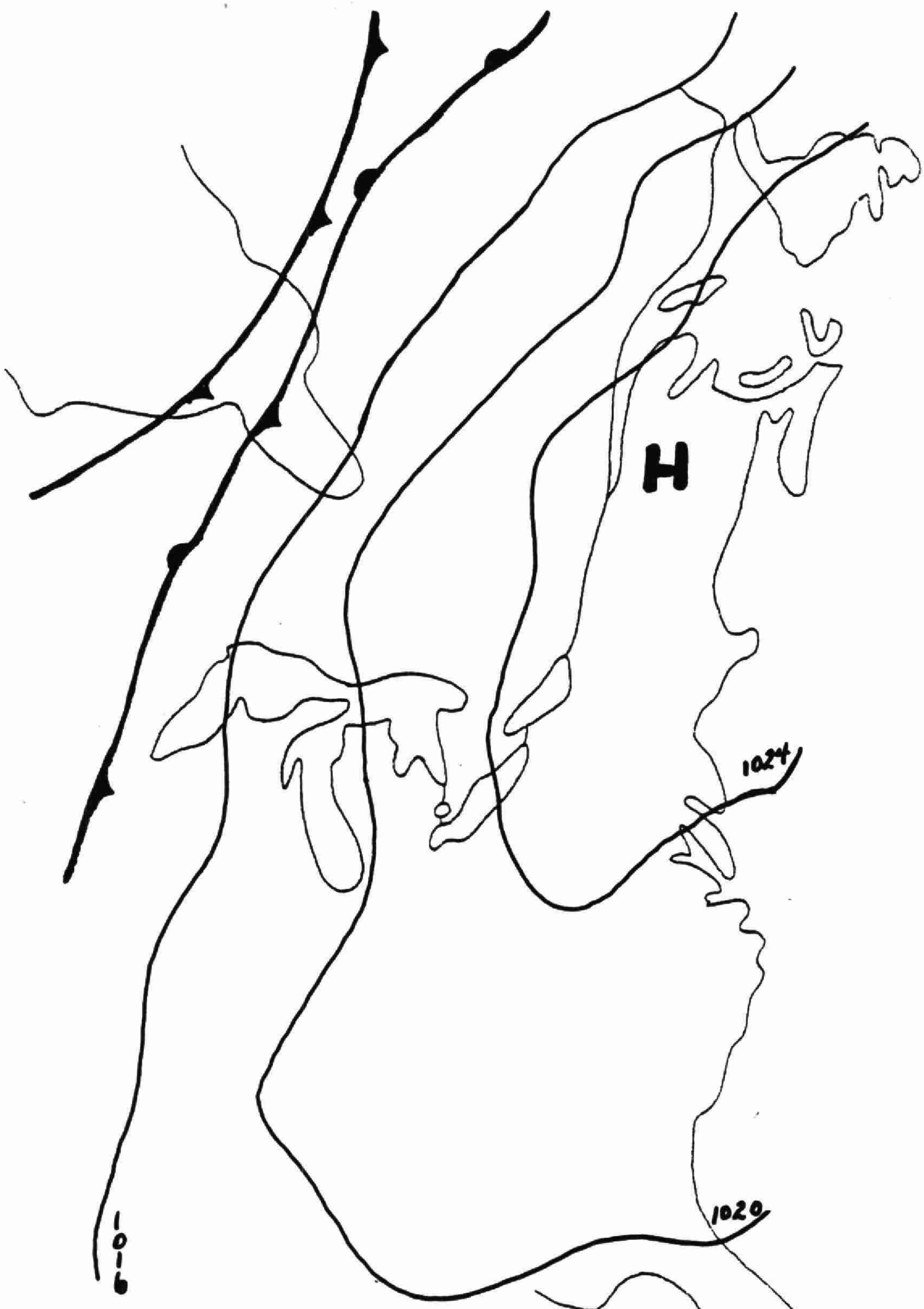


Figure 15a Diurnal Pattern of Winds for September 13,1982 at the Jarvis Met Tower

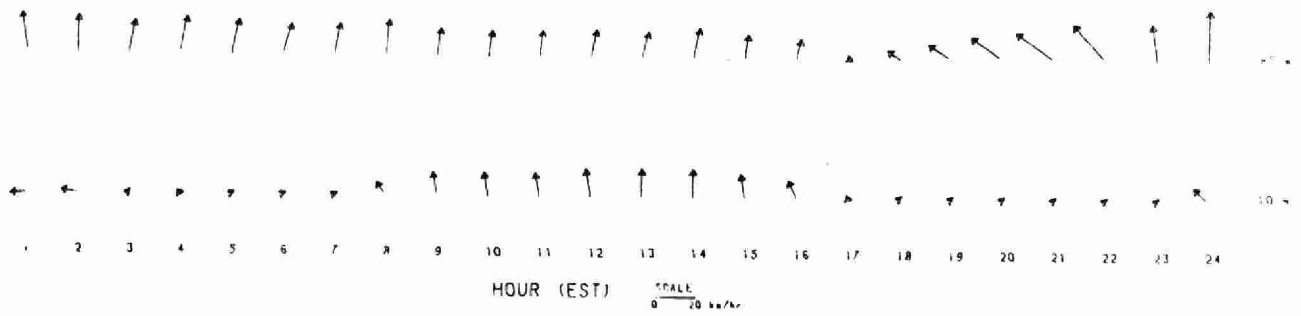


Figure 15b 48 Hour Back Trajectory Plot for September 13,1982

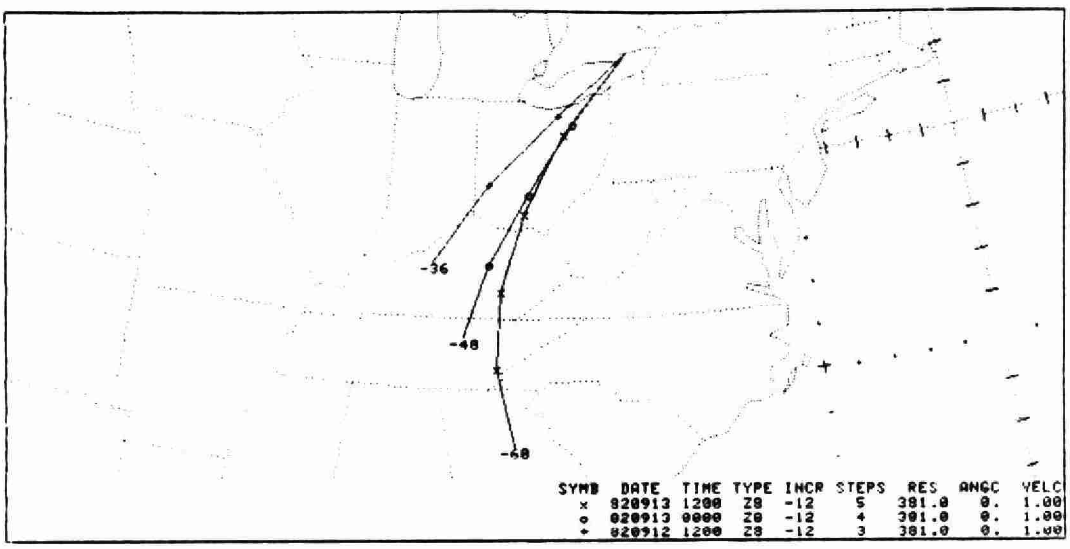


Figure 15c Diurnal Pattern of Ozone Concentration for September 13,1982

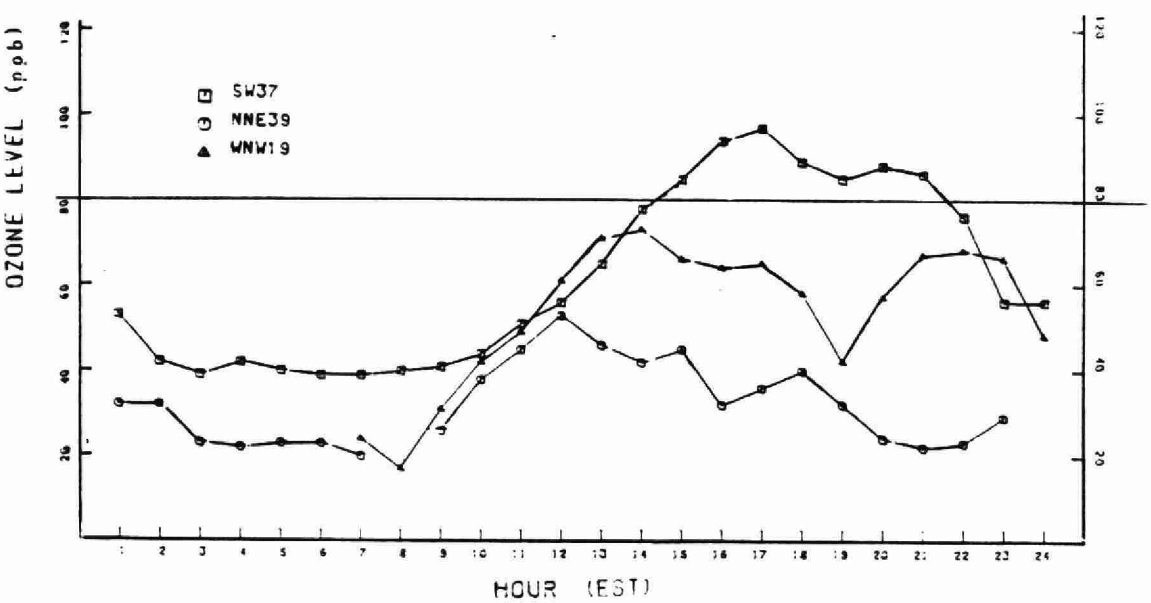


Figure 16

SURFACE SYNOPTIC MAP FOR JULY 8,1979
1300 EST

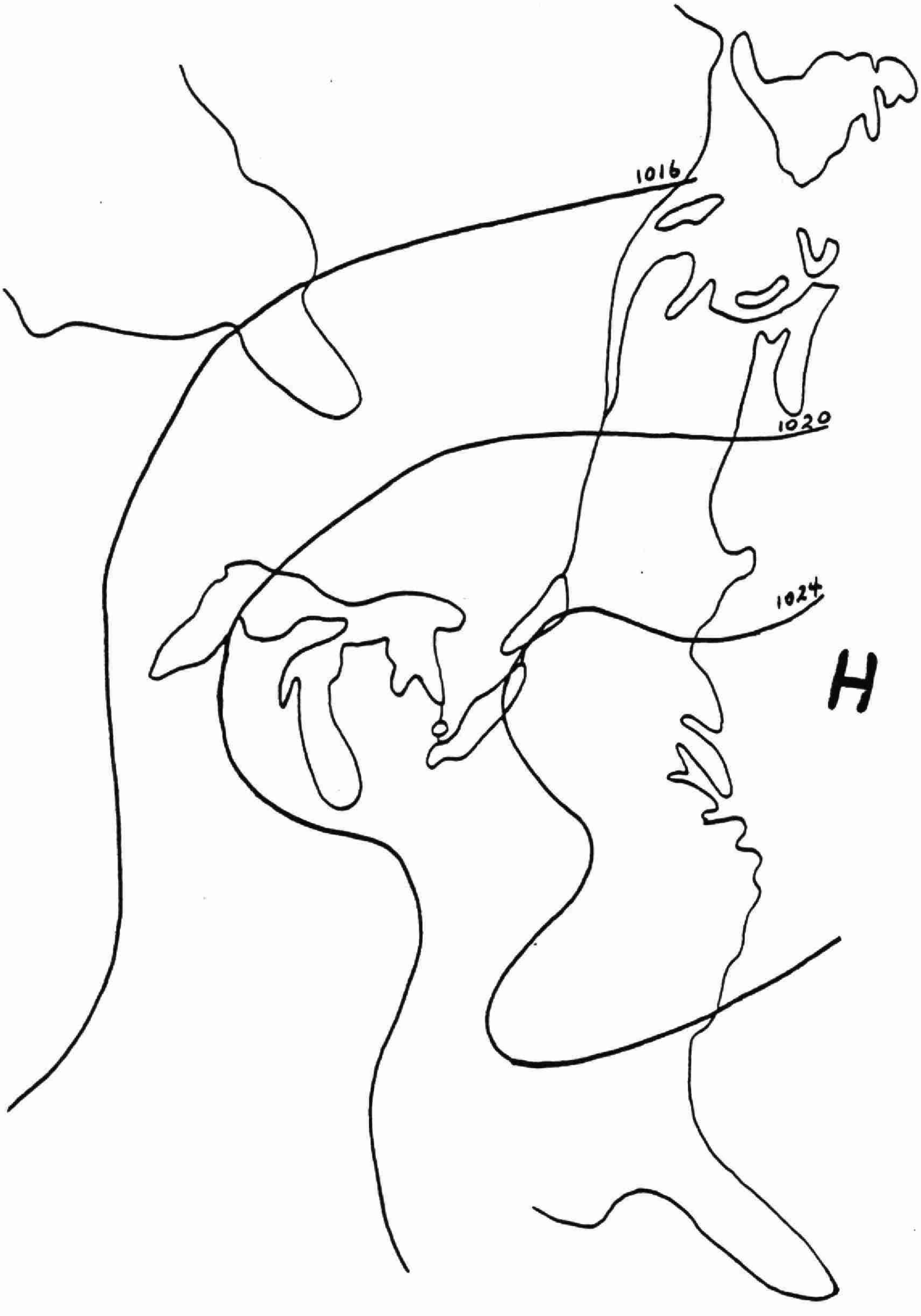


Figure 17a Diurnal Pattern of Winds for July 8,1979
at the Jarvis Met Tower

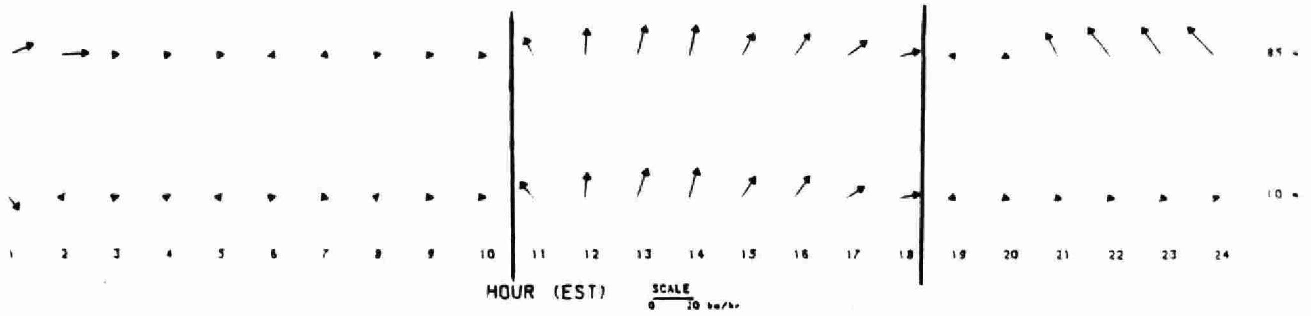


Figure 17b Diurnal Pattern of Ozone Concentration for
July 8,1979

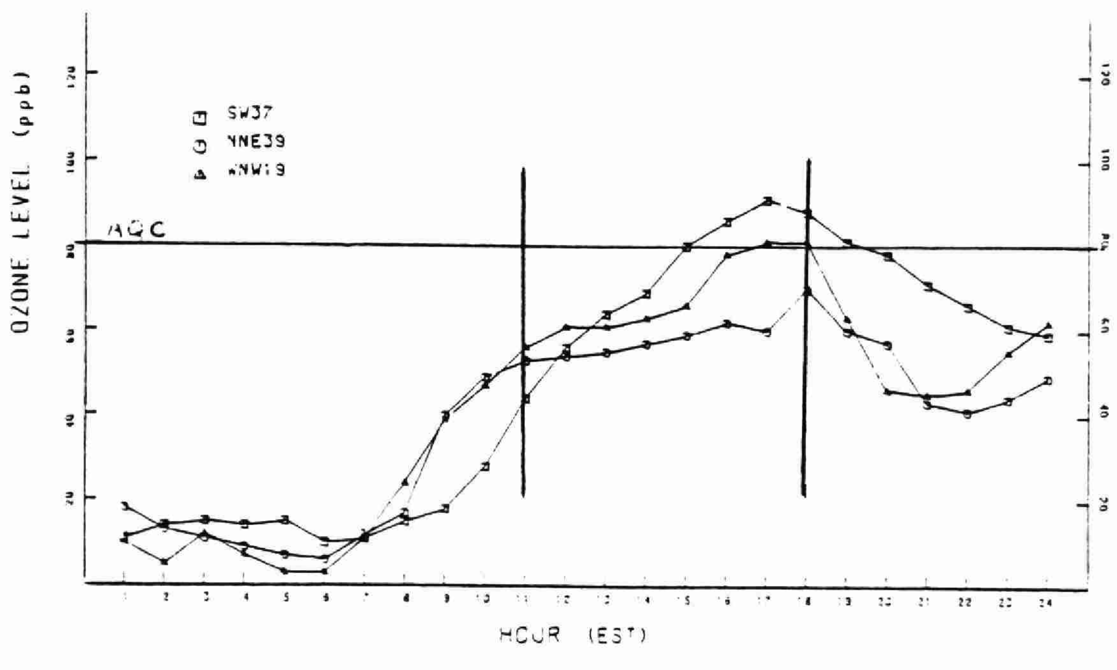


FIGURE 18

SURFACE SYNOPTIC MAP FOR JULY 19,1981
0100 EST

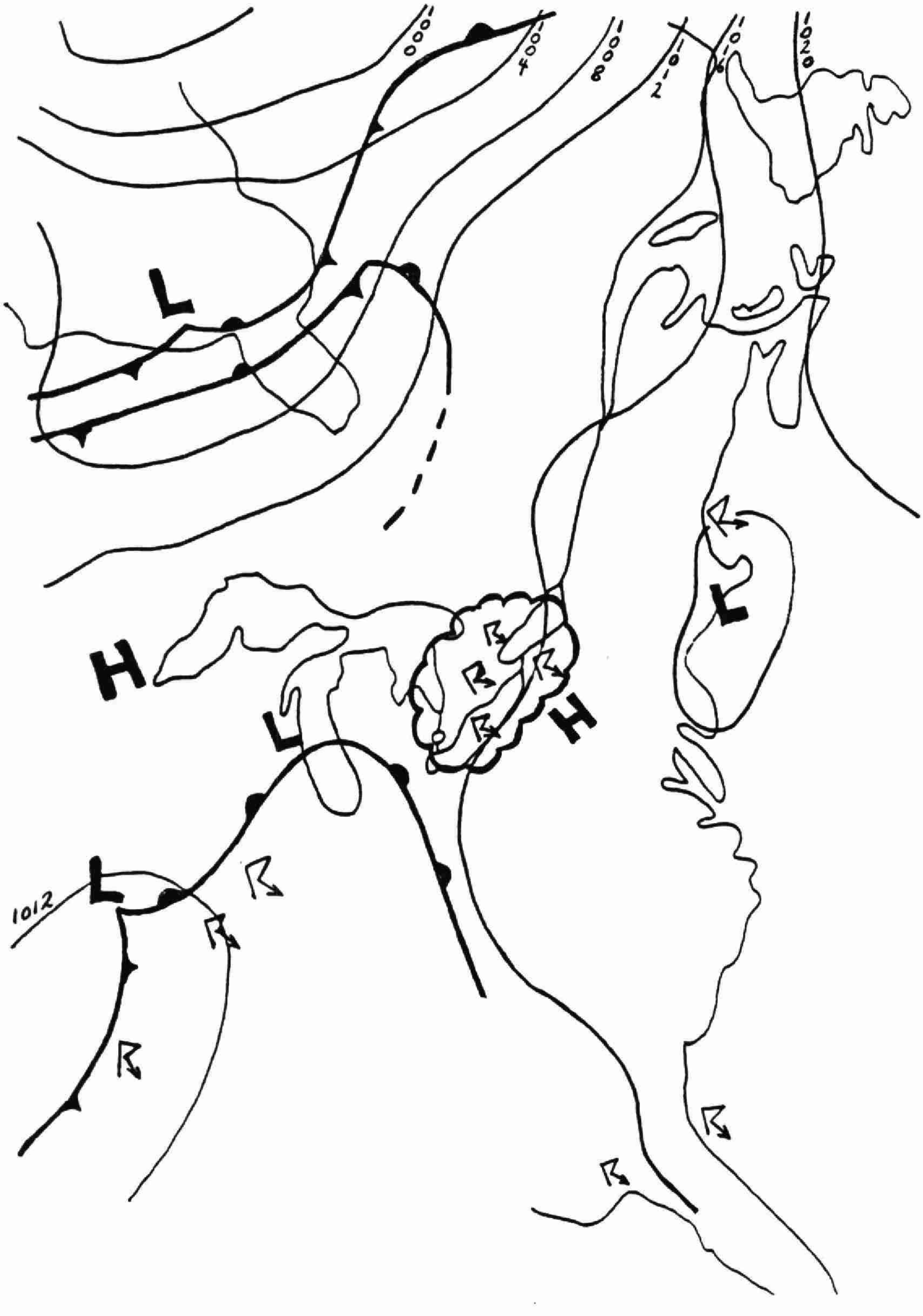


Figure 19a Diurnal Pattern of Ozone Concentration for July 19,1981

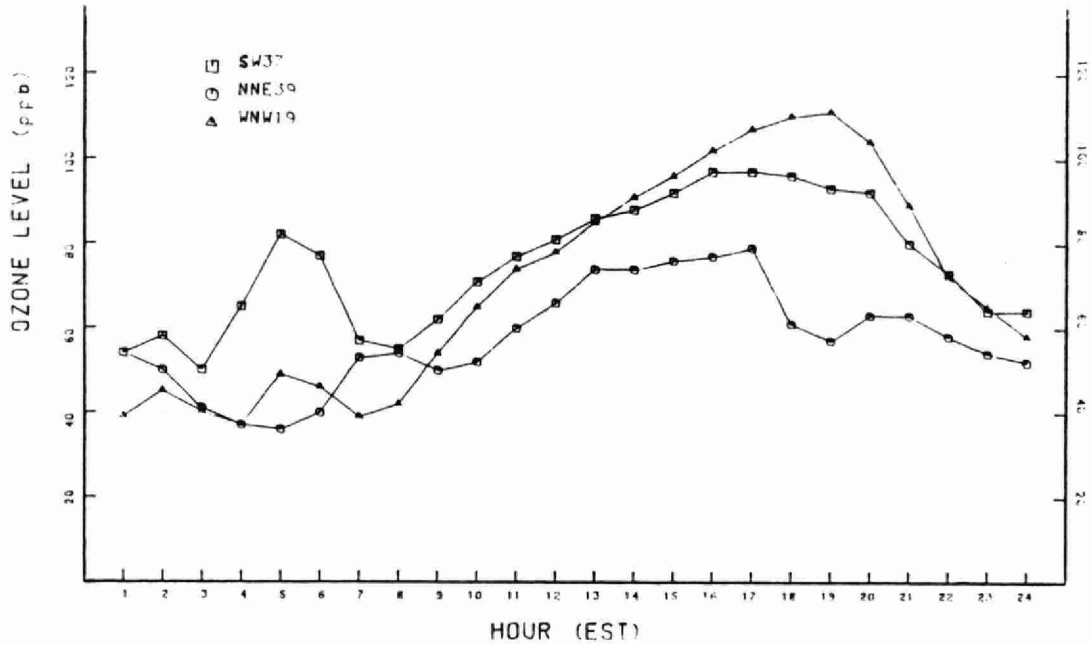


Figure 19b 48 Hour Back Trajectory Plot for July 19,1981

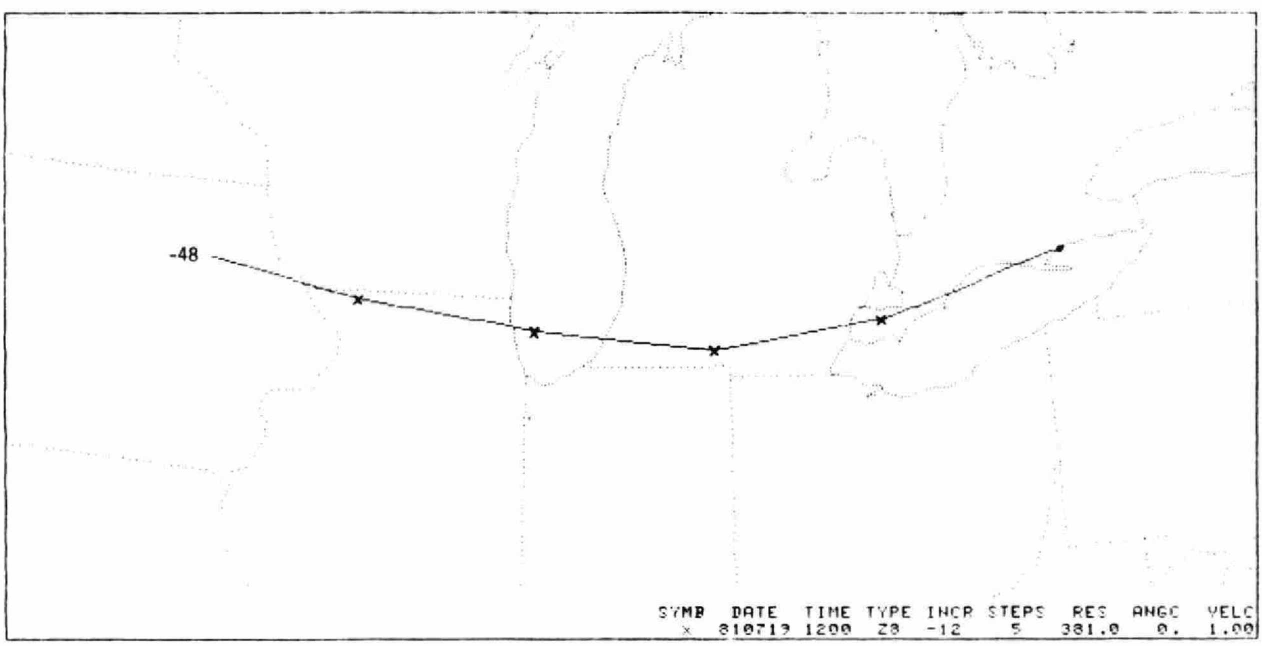


FIGURE 20

SURFACE SYNOPTIC MAP FOR JUNE 3,1982
1300 EST

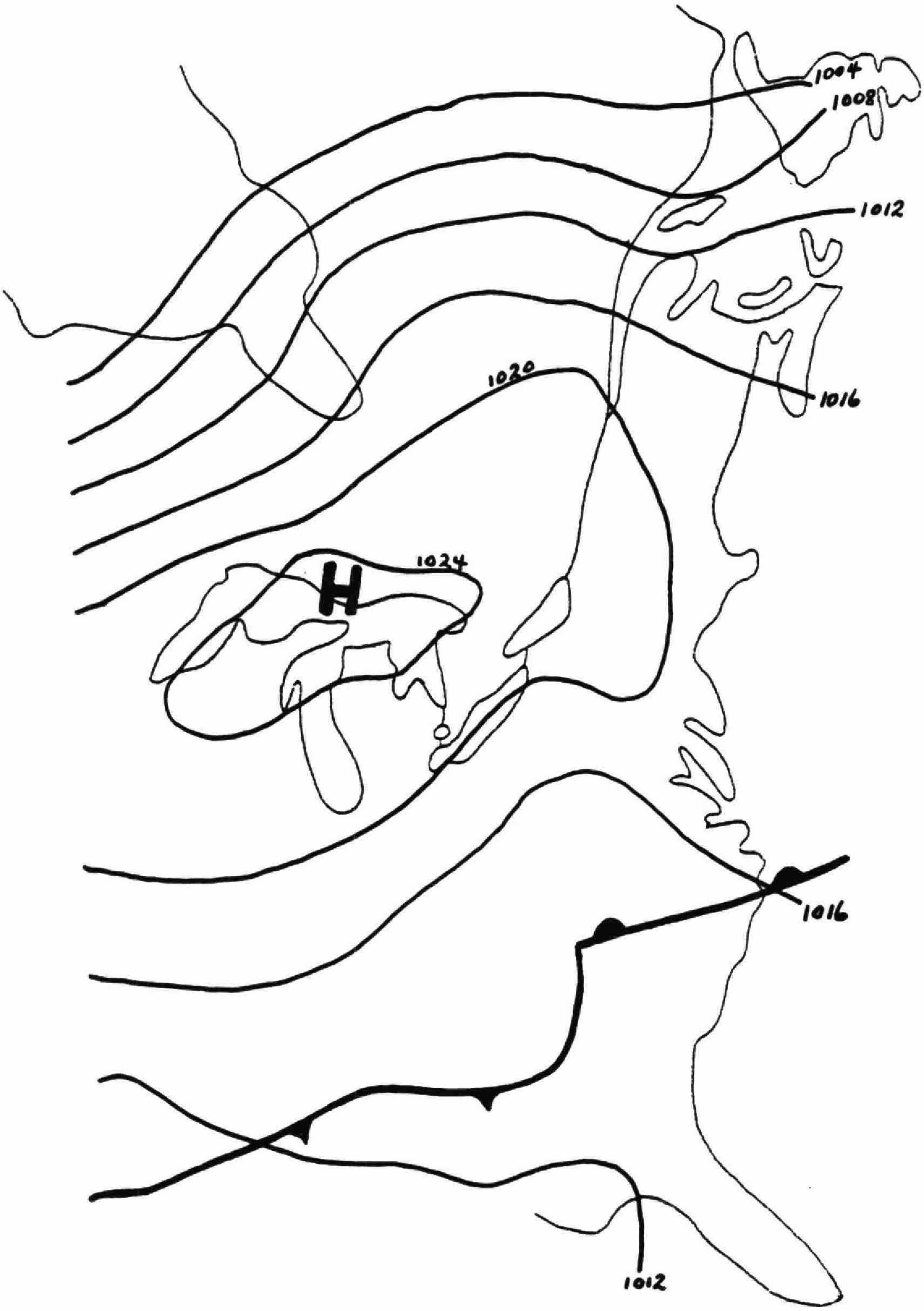


Figure 21a Diurnal Pattern of Ozone Concentration for
June 3,1982

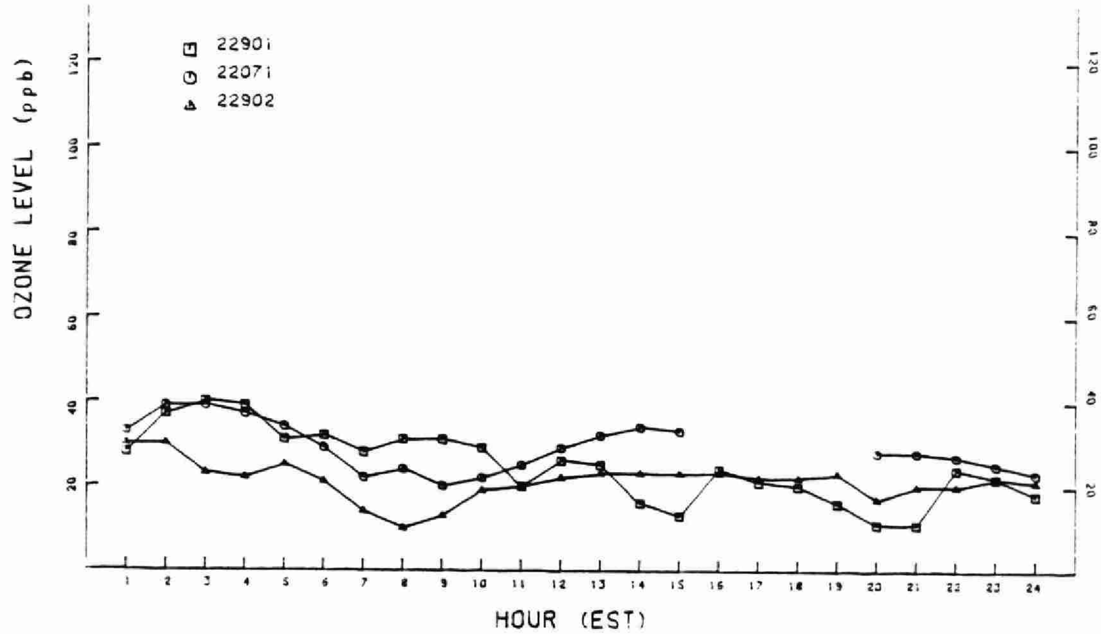
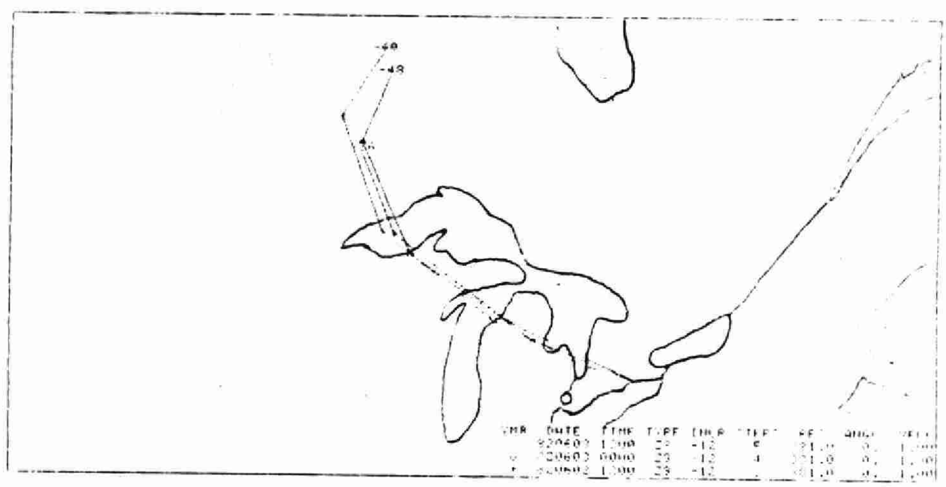


Figure 21b 48 Hour Back Trajectory Plot for June 3,1982



Appendix:

Ozone Episode Data Summary by Station

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
79/ 4/25	SW37	-	-	77	-	-		
	NNE39	-	-	69	-	-	24	backside of anticyclone
	WNW19	3	1600-1800	82	WSW	15		
79/ 5/ 8	SW37	8	1500-2200	104	SSW	24		
	NNE39	-	-	75	-	-	29	backside of anticyclone
	WNW19	4	1600-1900	89	SSW	23		
79/ 5/11	SW37	3	1500-1700	108	SSW	21		
	NNE39	-	-	61	-	-	30	backside of anticyclone
	WNW19	-	-	78	-	-		
79/ 6/ 1	SW37	-	-	69	-	-		
	NNE39	-	-	80	-	-	26	lake breeze
	WNW19	4	1500-1800	98	NE	9		
79/ 6/ 4	SW37	-	-	78	-	-		
	NNE39	-	-	65	-	-	27	backside of anticyclone
	WNW19	3	1700-1900	88	SW	24		
79/ 6/14	SW37	-	-	-	-	-		
	NNE39	-	-	-	-	-	25	backside of anticyclone
	WNW19	3	1700-1900	89	SSW	26		
79/ 6/15	SW37	-	-	-	-	-		
	NNE39	-	-	77	-	-	29	backside of anticyclone
	WNW19	10	1300-2200	96	SW	36		
79/ 6/16	SW37	-	-	-	-	-		
	NNE39	-	-	77	-	-	31	backside of anticyclone
	WNW19	9	1100-1900	96	SW	26		
79/ 6/17	SW37	-	-	-	-	-		
	NNE39	3	1800-2000	99	SSW	25	29	backside of anticyclone
	WNW19	9	1200-2000	105	SSW	30		
79/ 6/26	SW37	-	-	-	-	-		
	NNE39	-	-	71	-	-	24	backside of anticyclone
	WNW19	3	1700-1900	82	SSW	20		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
79/ 6/27	SW37	5	1300-1700	90	SSW	28		
	NNE39	-	-	71	-	-	26	backside of anticyclone
	WNW19	3	1300-1500	84	SSW	32		
79/ 7/ 8	SW37	4	1600-1900	91	SW	7		
	NNE39	-	-	70	-	-	27	lake breeze
	WNW19	2	1700-1800	81	WSW	9		
79/ 7/11	SW37	8	1400-2100	114	WSW	20		
	NNE39	-	-	-	-	-	28	lake breeze
	WNW19	2	1500-1600	85	SW	22		
79/ 7/12	SW37	-	-	70	-	-		
	NNE39	-	-	74	-	-	29	lake breeze
	WNW19	3	1500-1700	84	SSW	19		
79/ 7/13	SW37	-	-	-	-	-		
	NNE39	4	1300-1600	118	ESE	14	31	frontal activity
	WNW19	-	-	78	-	-		
79/ 7/20	SW37	-	-	-	-	-		
	NNE39	3	1800-2000	81	SSE	11	27	lake breeze
	WNW19	2	1100-1200	86	SSW	9		
79/ 7/21	SW37	-	-	-	-	-		
	NNE39	10	1200-2100	100	SSW	17	29	lake breeze
	WNW19	8	1300-2000	101	SSW	17		
79/ 7/22	SW37	-	-	-	-	-		
	NNE39	12	1000-2200	90	SSW	17	30	lake breeze
	WNW19	11	1000-2000	148	SSW	17		
79/ 8/ 3	SW37	-	-	-	-	-		
	NNE39	-	-	66	-	-	27	backside of anticyclone
	WNW19	3	1200-1500	84	SW	28		
79/ 8/ 4	SW37	-	-	-	-	-		
	NNE39	-	-	50	-	-	29	backside of anticyclone
	WNW19	4	1800-2100	85	WSW	20		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
79/ 9/ 1	SW37	-	-	-	-	-		
	NNE39	1	1600-1600	81	SSE	11	27	backside of anticyclone
	WNW19	4	1400-1700	93	SSE	11		
79/ 9/ 6	SW37	4	1400-1700	124	W	33		
	NNE39	-	-	59	-	-	28	frontal activity
	WNW19	-	-	19	-	-		
79/ 9/25	SW37	3	1500-1700	88	SSW	27		
	NNE39	-	-	59	-	-	22	backside of anticyclone
	WNW19	-	-	64	-	-		
80/ 5/22	SW37	6	1600-2100	88	WSW	17		
	NNE39	-	-	78	-	-	27	backside of anticyclone
	WNW19	-	-	69	-	-		
80/ 5/23	SW37	5	1500-2000	91	S	6		
	NNE39	-	-	69	-	-	28	backside of anticyclone
	WNW19	-	-	75	-	-		
80/ 5/24	SW37	-	-	71	-	-		
	NNE39	2	1500-1600	99	SW	10	27	backside of anticyclone
	WNW19	4	1500-1800	84	SW	8		
80/ 6/18	SW37	5	1700-2100	91	W	15		
	NNE39	-	-	69	-	-	22	backside of anticyclone
	WNW19	-	-	66	-	-		
80/ 6/22	SW37	9	1500-2300	105	SSW	20		
	NNE39	-	-	65	-	-	26	backside of anticyclone
	WNW19	-	-	52	-	-		
80/ 6/23	SW37	12	1300-2300	108	SW	17		
	NNE39	3	1600-1800	82	-	19	28	backside of anticyclone
	WNW19	-	-	75	-	-		
80/ 6/24	SW37	14	1300-2400	118	S	12		
	NNE39	8	1300-1900	102	S	10	28	backside of anticyclone
	WNW19	7	1200-2000	92	S	10		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
80/ 6/25	SW37	3	1300-1500	88	SSW	21		
	NNE39	2	1300-1400	89	SSW	19	28	backside of anticyclone
	WNW19	1	1200-1200	83	SSW	15		
80/ 6/26	SW37	-	-	77	-	-		
	NNE39	-	-	70	-	-	29	backside of anticyclone
	WNW19	7	1400-2000	95	SW	28		
80/ 7/ 1	SW37	4	1700-2000	93	SSW	22		
	NNE39	-	-	65	-	-	24	backside of anticyclone
	WNW19	-	-	62	-	-		
80/ 7/ 4	SW37	8	1600-2300	93	SSW	8		
	NNE39	-	-	70	-	-	28	backside of anticyclone
	WNW19	-	-	63	-	-		
80/ 7/19	SW37	15	1200-2300	123	WSW	24		frontal activity --
	NNE39	-	-	-	-	-	29	thunderstorm
	WNW19	7	1300-2000	99	SW	25		
80/ 7/20	SW37	15	1100-2200	111	SSW	20		frontal activity/
	NNE39	-	-	-	-	-	30	influence of anticyclone
	WNW19	7	1500-2100	93	SSW	19		
80/ 7/21	SW37	12	1500-2300	111	SW	20		frontal activity --
	NNE39	-	-	-	-	-	31	thunderstorm
	WNW19	-	-	-	-	-		
80/ 7/22	SW37	10	1500-2200	100	S	14		frontal activity --
	NNE39	-	-	-	-	-	24	thunderstorm
	WNW19	-	-	46	-	-		
80/ 7/25	SW37	5	1300-1700	108	SSW	28		
	NNE39	-	-	62	-	-	28	backside of anticyclone
	WNW19	-	-	67	-	-		
80/ 7/26	SW37	4	1300-1600	113	NW	10		frontal activity --
	NNE39	-	-	52	-	-	25	showers
	WNW19	-	-	65	-	-		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
80/ 7/27	SW37	6	1300-1800	93	NE	10		frontal activity --
	NNE39	-	-	51	-	-	27	thunderstorm
	WNW19	-	-	79	-	-		
80/ 7/29	SW37	8	1900-2300	99	WSW	17		
	NNE39	-	-	-	-	-	27	backside of anticyclone
	WNW19	-	-	71	-	-		
80/ 7/31	SW37	3	1200-1400	93	SSE	13		frontal activity --
	NNE39	-	-	-	-	-	24	showers
	WNW19	-	-	53	-	-		
80/ 8/ 1	SW37	8	1400-2100	121	WSW	19		frontal activity --
	NNE39	-	-	61	-	-	29	influence of anticyclone
	WNW19	2	1800-1900	87	SW	20		
80/ 8/ 6	SW37	3	1800-2000	89	SW	19		
	NNE39	-	-	53	-	-	29	backside of anticyclone
	WNW19	-	-	66	-	-		
80/ 8/ 7	SW37	7	1300-1900	92	SW	30		
	NNE39	-	-	67	-	-	29	backside of anticyclone
	WNW19	-	-	77	-	-		
80/ 8/26	SW37	3	2100-2300	90	WSW	18		
	NNE39	-	-	42	-	-	28	backside of anticyclone
	WNW19	4	1500-1800	82	SSW	20		
81/ 5/ 5	SW37	-	-	75	-	-		frontal activity
	NNE39	1	1500-1500	81	-	21	24	
	WNW19	3	1300-1500	91	-	18		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
81/ 5/22	SW37	6	1600-2100	98	ESE	12		
	NNE39	5	1400-1800	93	ESE	15	27	backside of anticyclone
	WNW19	1	1400-1400	81	ESE	18		
81/ 5/23	SW37	11	1400-2300	129	SSW	14		
	NNE39	7	1200-2000	84	S	13	26	backside of anticyclone
	WNW19	8	1200-1900	107	S	13		
81/ 5/24	SW37	-	-	-	-	-		frontal activity/
	NNE39	7	1400-1900	91	SSW	10	26	influence of anticyclone
	WNW19	9	1300-1800	100	SSW	12		
81/ 6/ 4	SW37	5	1500-1900	91	WNW	16		frontal activity
	NNE39	-	-	63	-	-	24	
	WNW19	-	-	61	-	-		
81/ 6/ 5	SW37	10	1400-2300	104	SW	21		
	NNE39	10	1300-2200	103	SW	21	26	backside of anticyclone
	WNW19	11	1200-2200	107	SW	21		
81/ 6/ 8	SW37	-	-	65	-	-		frontal activity --
	NNE39	1	1700-1700	83	SSW	35	25	thunderstorm
	WNW19	3	1500-1700	85	SSW	34		
81/ 6/12	SW37	4	1500-1800	95	WSW	21		
	NNE39	-	-	55	-	-	26	backside of anticyclone
	WNW19	-	-	76	-	-		
81/ 6/18	SW37	-	-	71	-	-		
	NNE39	-	-	-	-	-	24	backside of anticyclone
	WNW19	4	1700-1900	86	SW	18		
81/ 6/19	SW37	5	1300-1700	89	-	15		
	NNE39	-	-	-	-	-	26	backside of anticyclone
	WNW19	4	1200-1500	86	SW	20		
81/ 6/29	SW37	-	-	-	-	-		
	NNE39	-	-	78	-	-	29	backside of anticyclone
	WNW19	13	1200-2300	110	SW	27		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
81/ 8/ 2	SW37	5	1500-1900	87	SSW	18	28	backside of anticyclone
	NNE39	-	-	73	-	-		
	WNW19	-	-	-	-	-		
81/ 8/22	SW37	10	1400-2300	88	-	-	25	backside of anticyclone
	NNE39	1	1700-1700	86	-	3		
	WNW19	4	1300-1700	99	SSW	8		
81/ 8/29	SW37	5	1600-2000	92	SE	16	23	backside of anticyclone
	NNE39	-	-	76	-	-		
	WNW19	-	-	79	-	-		
81/ 9/11	SW37	3	1700-1900	89	SSW	15	23	backside of anticyclone
	NNE39	-	-	55	-	-		
	WNW19	2	1700-1800	86	SSW	13		
81/ 9/13	SW37	-	-	80	-	-		
	NNE39	-	-	69	-	-	27	backside of anticyclone
	WNW19	7	1200-1800	95	SW	21	27	
81/ 9/26	SW37	2	1700-1800	83	SSW	30	22	backside of anticyclone
	NNE39	-	-	72	-	-		
	WNW19	3	1700-1900	84	SSW	32		
82/ 4/25	SW37	8	1600-2300	94	SE	8	21	backside of anticyclone
	NNE39	-	-	61	-	-		
	WNW19	5	1400-1800	89	SW	17		
82/ 5/ 6	SW37	8	1500-2200	102	SSW	19	28	backside of anticyclone
	NNE39	-	-	70	-	-		
	WNW19	12	1100-1800	98	SW	20		
82/ 5/12	SW37	-	-	76	-	-	25	backside of anticyclone
	NNE39	-	-	67	-	-		
	WNW19	4	1400-1700	94	-	8		
82/ 5/29	SW37	1	1500-1500	82	-	-	23	lake breeze
	NNE39	-	-	68	-	-		
	WNW19	3	1500-1700	83	SE	9		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP ('C)	METEOROLOGICAL CONDITIONS
82/ 5/31	SW37	-	-	77	-	-	25	lake breeze
	NNE39	-	-	45	-	-		
	WNW19	4	1600-1900	84	S	15		
82/ 6/14	SW37	3	1800-2000	88	W	15	24	backside of anticyclone
	NNE39	-	-	37	-	-		
	WNW19	-	-	78	-	-		
82/ 6/18	SW37	10	1500-2300	93	SSW	11	24	backside of anticyclone
	NNE39	-	-	52	-	-		
	WNW19	5	1400-1800	89	SSW	15		
82/ 6/24	SW37	6	1600-2100	94	SSW	21	21	backside of anticyclone
	NNE39	-	-	50	-	-		
	WNW19	-	-	66	-	-		
82/ 6/25	SW37	12	1300-2300	101	WSW	15	23	backside of anticyclone
	NNE39	-	-	49	-	-		
	WNW19	5	1600-2000	89	WSW	16		
82/ 6/28	SW37	3	1700-1900	84	SSE	8	26	backside of anticyclone
	NNE39	-	-	60	-	-		
	WNW19	4	1200-1700	84	-	6		
82/ 7/ 6	SW37	-	-	60	-	-	29	backside of anticyclone
	NNE39	-	-	61	-	-		
	WNW19	3	1700-1900	89	SSW	16		
82/ 7/10	SW37	-	-	-	-	-	28	backside of anticyclone
	NNE39	-	-	76	-	-		
	WNW19	4	1500-1800	111	ESE	11		
82/ 7/15	SW37	-	-	-	-	-	30	lake breeze
	NNE39	-	-	41	-	-		
	WNW19	6	1400-1900	90	SSW	16		
82/ 7/16	SW37	14	1300-2300	114	S	13	30	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	10	1200-1900	115	SSW	12		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP ('C)	METEOROLOGICAL CONDITIONS
82/ 7/17	SW37	5	1500-1900	87	SW	20	29	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	1	1200-1200	84	-	-		
82/ 7/22	SW37	3	1700-1900	91	-	9	28	lake breeze
	NNE39	1	1600-1600	82	-	-		
	WNW19	-	-	77	-	-		
82/ 7/25	SW37	11	1400-2300	89	WSW	23	30	backside of anticyclone
	NNE39	-	-	76	-	-		
	WNW19	8	1300-2000	93	WSW	24		
82/ 7/30	SW37	-	-	-	-	-	28	backside of anticyclone
	NNE39	-	-	65	-	-		
	WNW19	3	1700-2000	83	SSW	13		
82/ 8/14	SW37	-	-	-	-	-	25	lake breeze
	NNE39	-	-	79	-	-		
	WNW19	5	1500-1900	93	SSW	19		
82/ 8/15	SW37	-	-	-	-	-	26	lake breeze
	NNE39	8	1200-1900	89	SSW	14		
	WNW19	12	1000-2100	102	SSW	12		
82/ 8/16	SW37	-	-	-	-	-	28	lake breeze
	NNE39	-	-	80	-	-		
	WNW19	7	1100-1900	89	SW	13		
82/ 8/30	SW37	3	1700-1900	92	SW	16	24	backside of anticyclone
	NNE39	-	-	42	-	-		
	WNW19	-	-	-	-	-		
82/ 9/10	SW37	9	1300-2100	106	SSW	16	28	backside of anticyclone
	NNE39	-	-	79	-	-		
	WNW19	1	-	81	-	-		
82/ 9/11	SW37	10	1500-2300	97	S	14	27	backside of anticyclone
	NNE39	-	-	71	-	-		
	WNW19	1	-	82	-	-		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
81/ 7/ 7	SW37	6	1900-2300	98	WSW	26	32	lake breeze
	NNE39	-	-	-	-	-		
	WNW19	7	1700-2300	98	WSW	22		
81/ 7/ 8	SW37	7	1300-1900	98	WSW	24	32	backside of anticyclone
	NNE39	2	1100-1200	84	WSW	18		
	WNW19	15	1000-2200	105	WSW	22		
81/ 7/11	SW37	5	1900-2300	85	WSW	17	30	lake breeze
	NNE39	-	-	55	-	-		
	WNW19	-	-	61	-	-		
81/ 7/12	SW37	9	1600-2300	113	SW	15	30	backside of anticyclone
	NNE39	3	1500-1800	85	SW	12		
	WNW19	8	1800-2300	100	SW	16		
81/ 7/13	SW37	-	-	-	-	-	30	frontal activity/ influence of anticyclone
	NNE39	-	-	69	-	-		
	WNW19	3	100- 300	96	WSW	21		
81/ 7/17	SW37	-	-	79	-	-	28	lake breeze
	NNE39	-	-	68	-	-		
	WNW19	4	1700-2000	90	SSW	21		
81/ 7/18	SW37	11	1300-2300	119	SSW	15	30	backside of anticyclone
	NNE39	-	-	68	-	-		
	WNW19	5	1700-2000	93	SW	14		
81/ 7/19	SW37	9	1200-2000	97	SW	17	30	frontal activity/ influence of anticyclone
	NNE39	-	-	79	-	-		
	WNW19	9	1300-2100	111	SW	17		
81/ 7/25	SW37	10	1500-2300	113	SSW	12	28	backside of anticyclone
	NNE39	3	1400-1700	87	S	12		
	WNW19							
81/ 8/ 1	SW37	9	1500-2300	92	SSW	14	27	backside of anticyclone
	NNE39	-	-	73	-	-		
	WNW19	-	-	-	-	-		

OZONE EPISODE DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (KM/HR)	MAX DAILY TEMP (°C)	METEOROLOGICAL CONDITIONS
82/ 9/12	SW37	5	1800-2300	82	ESE	20		backside of quasi-
	NNE39	-	-	80	-	-	28	stationary anticyclone
	WNW19	2	1500-1600	83	SSE	9		
82/ 9/13	SW37	7	1500-2100	97	SSE	11		backside of quasi-
	NNE39	-	-	53	-	-	29	stationary anticyclone
	WNW19	-	-	73	-	-		
83/ 4/27	SW37	-	-	78	-	-		
	NNE39	-	-	66	-	-	22	backside of anticyclone
	WNW19	3	1700-1900	89	WSW	21		
83/ 6/10	SW37	-	-	61	-	-		
	NNE39	-	-	73	-	-	26	backside of anticyclone
	WNW19	7	1300-1900	98	SW			
83/ 6/11	SW37	-	-	-	-	-		
	NNE39	3	1600-1800	87	SSW	18	26	backside of anticyclone
	WNW19	10	1400-2300	100	SW	17		
83/ 6/12	SW37	-	-	-	-	-		
	NNE39	7	1200-1800	92	SSW	16	30	lake breeze
	WNW19	15	1000-2100	113	SSW	14		
83/ 6/13	SW37	-	-	-	-	-		
	NNE39	3	1300-1500	95	S	13	29	lake breeze
	WNW19	11	1000-2000	97	SSW	10		
83/ 6/14	SW37	11	1400-2300	-	-	6		
	NNE39	9	1100-1900	116	SE	9	30	backside of anticyclone
	WNW19	15	900-2300	123	-	6		
83/ 6/15	SW37	13	1200-2100	107	SSW	16		
	NNE39	3	1600-1800	93	SW	16	30	backside of anticyclone
	WNW19	13	200- 500	109	SE	13		
83/ 6/16	SW37	9	1600-2300	127	SW	16		
	NNE39	3	1200-1400	85	S	12	29	lake breeze
	WNW19	2	1000-1100	85	-	5		

OZONE (O3) DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (km/hr)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
83/ 6/17	SW37	1	100- 100	85	SSW	15	29	lake breeze
	NNE39	-	-	73	-	-		
	WNW19	4	1400-1800	85	SSW	14		
83/ 6/21	SW37	3	1700-1900	91	NE	16	29	backside of anticyclone
	NNE39	-	-	60	-	-		
	WNW19	-	-	77	-	-		
83/ 6/22	SW37	5	1500-1900	88	S	9	28	backside of anticyclone
	NNE39	-	-	63	-	-		
	WNW19	-	-	79	-	-		
83/ 6/23	SW37	10	1300-2200	112	SSW	23	31	backside of anticyclone
	NNE39	2	1400-1500	81	SSW	24		
	WNW19	9	1300-2100	92	SW	24		
83/ 6/26	SW37	11	1300-2300	106	SW	25	31	backside of anticyclone
	NNE39	1	1800-1800	83	SW	26		
	WNW19	11	1300-2300	103	SW	25		
83/ 6/27	SW37	2	1300- 000	93	SSW	17	31	frontal activity/ influence of anticyclone
	NNE39	-	-	77	-	-		
	WNW19	6	1000-1500	105	SSW	13		
83/ 7/ 1	SW37	1	1500-1500	81	SW	36	29	backside of anticyclone
	NNE39	-	-	57	-	-		
	WNW19	4	1400-1700	92	SW	33		
83/ 7/ 3	SW37	-	-	76	-	-	31	backside of anticyclone
	NNE39	-	-	56	-	-		
	WNW19	3	1700-1900	91	SSW	21		
83/ 7/11	SW37	10	1500-2300	102	SW	21	27	backside of anticyclone
	NNE39	-	-	78	-	-		
	WNW19	3	2400-2400	90	-	26		
83/ 7/12	SW37	4	1400-1700	95	WNW	26	32	backside of anticyclone
	NNE39	-	-	75	-	-		
	WNW19	2	1200-1200	85	W	18		

OZONE (O3) DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (km/hr)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
83/ 7/14	SW37	9	1600-2300	96	WSW	23		
	NNE39	6	1700-2300	94	WSW	23	32	backside of anticyclone
	WNW19	12	1300-2300	104	SW	22		
83/ 7/15	SW37	16	1200-2300	119	WNW	25		
	NNE39	-	-	73	-	-	34	backside of anticyclone
	WNW19	-	-	80	-	-		
83/ 7/16	SW37	12	1200-2200	107	WNW	25		
	NNE39	-	-	56	-	-	34	backside of anticyclone
	WNW19	-	-	67	-	-		
83/ 7/28	SW37	7	1200-1800	112	SSW	23		
	NNE39	3	1400-1600	87	SW	23	30	frontal activity -- thunderstorm
	WNW19	9	1100-1900	92	SSW	22		
83/ 8/ 3	SW37	3	1800-2000	92	SW	14		
	NNE39	-	-	66	-	-	28	backside of anticyclone
	WNW19	-	-	74	-	-		
83/ 8/ 7	SW37	-	-	78	-	-		
	NNE39	-	-	62	-	-	29	lake breeze
	WNW19	3	1800-2000	93	WSW	17		
83/ 8/ 8	SW37	-	-	55	-	-		
	NNE39	1	1800-1800	81	WSW	34	29	backside of anticyclone
	WNW19	4	1500-1800	105	WSW	31		
83/ 8/16	SW37	-	-	-	-	-		
	NNE39	-	-	80	-	-	27	lake breeze
	WNW19	4	1400-1700	87	SSW	13		
83/ 8/17	SW37	-	-	-	-	-		frontal activity -- thunderstorm
	NNE39	-	-	-	-	-	29	
	WNW19	5	1300-1700	96	SW	16		
83/ 8/19	SW37	7	1600-2200	136	SSW	26		
	NNE39	-	-	-	-	-	29	backside of anticyclone
	WNW19	6	1800-2300	107	SW	30		

OZONE (O3) DATA SUMMARY BY STATION

DATE YY/MM/DD	STATION ID	EXCEEDANCE HOURS	PERIOD OF EXCEEDANCE	MAXIMUM CONC (ppb)	AVG WIND DIRECTION	AVG SPEED (km/hr)	MAX DAILY TEMP (C)	METEOROLOGICAL CONDITIONS
83/ 8/25	SW37	10	1400-2300	100	S	10	27	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	2	1600-2300	83	S	11		
83/ 8/26	SW37	-	-	80	-	-	29	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	4	1700-1900	87	SW	15		
83/ 9/ 9	SW37	9	1300-2100	107	SW	25	28	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	5	1800-2200	98	SW	25		
83/ 9/10	SW37	6	1400-1900	85	SW	25	32	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	1	1700-1700	81	SW	25		
83/10/ 3	SW37	4	1600-1900	87	SW	28	25	backside of anticyclone
	NNE39	-	-	-	-	-		
	WNW19	4	1500-1800	82	SW	32		